Port of Seattle Submittal
For RFA 6-26-92

WA 2917
7-24-90
Ta

Converse GES

Geoenvironmental Services

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INTERIM PRODUCT EXTRACTION SYSTEM REMEDIAL ACTION PLAN

Terminal 91

Seattle, Washington

Prepared for:

Pacific Northern Oil

Converse Project No. 89-45527-03

July 26, 1990

Converse GES

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Pacific Northern Oil
North Tower - Suite 200
100 West Harrison Plaza
Seattle, Washington 98119

Attention: Mr George Markwood

Subject: Interim Product Extraction System Remedial Action Plan
Terminal 91
Seattle, Washington

Our Interim Product Extraction System Remedial Action Plan accompanies this letter. The report presents a narrative of the extraction system presented in the May 25, 1990 design drawings. In addition, we have also incorporated results of our pump test indicating the anticipated capture zone; additional groundwater elevation data obtained since our field work last fall for the Phase I Remedial Investigation; and results of a priority pollutant scan run on well MW-3 as part of the Municipality of Metropolitan Seattle (Metro) permit application. Additional copies of this report are being forwarded to Dan Cargill at Department of Ecology, Doug Hotchkiss at the Port of Seattle, Jackie Eden with Metro, and Lieutenant Van Trogen with the Seattle Fire Department for a 14-day review period.

Pending receipt of review comments, the final Metro discharge permit and the fire permit, we anticipate ordering the equipment in about two weeks and installation of the system sometime in late August. We still need to discuss billing rates with the Port and the City for our use of their lift stations.

Sincerely,

CONVERSE CONSULTANTS NW

John J. Strunk
Hydrogeologist

Erick W. Miller
Project Hydrogeologist

INTERIM PRODUCT EXTRACTION SYSTEM
REMEDIAL ACTION PLAN

BACKGROUND

This report presents the plans for an interim product extraction system for the fuel spill at the Terminal 91 pipeline, Seattle, Washington. Results of previous investigations (Hart Crowser, September 11, 1989; Converse GES, July 5, 1990) at the Terminal 91 facility indicated the presence of floating diesel hydrocarbons on the water table in the vicinity of the pipeline operated by Pacific Northern Oil (PNO). The site location is shown in Figure 1 and the site layout is presented in Figure 2.

The spill area is located south of the guard shack at the West Garfield Street entrance, and west of the retaining wall and Lake Jacobs (Figure 2). One monitoring well in this area, MW-3, had measurable floating product, ranging in thickness from 0.24 to 0.69 foot. A product sheen observed on Lake Jacobs, located immediately adjacent to MW-3, is thought to be seeping through cracks in the retaining wall. The estimated areal extent of free product is shown in Figure 2. The areal extent of free product encountered in MW-3 is constrained by monitoring wells MW-102, MW-11, MW-6, and MW-2. Product has been measured in MW-102 on one occasion in April 1990. The eastern extent of free product is constrained by the bulkhead retaining wall. During excavation of a portion of the pipeline just east of MW-11, a thin 0.01-foot product layer was encountered on the water table. It is estimated that between 340 to 1,370 gallons of free product are present on the site in the area around MW-3.

As an immediate response to control the migration of the diesel product and removal of free product, an interim product extraction system will be implemented at the PNO pipeline site.

SYSTEM SUMMARY

The system layout is presented in Drawing 3 of the Interim Groundwater Extraction and Treatment System design drawings, June 21, 1990, Converse GES. The interim product extraction system will consist of a 6-inch diameter, 24-foot deep extraction well and a pneumatic total fluids pump. The total fluids pumped from the extraction well will be passed through a coalescing plate oil/water separator. The separated phase will be stored in a double-contained product storage tank and recycled into PNO's bulk fuel supply. The water will be discharged into the sanitary sewer. The system is designed for continuous, unattended operation. High-level switches will be installed in the oil/water separator and the product storage tanks to allow for complete system shutdown should high levels occur. In addition, a lower explosive limit (LEL) sensor, linked to a system shutoff switch, will monitor effluent prior to discharge to the sanitary sewer. Complete system shutdown will occur if the LEL sensor detects greater than 5 percent of the lower explosive limit.

A brief description of the site's hydrogeology, results of a pump test, and a detailed description of each component of the system is discussed below.

SITE HYDROGEOLOGY

Details of the site geology, groundwater flow, and tidal influence are provided in Phase I Remedial Investigation (RI). Presented below is a summary of groundwater elevation data including data compiled since completion of the Phase I RI field work in December, 1990.

Groundwater elevation contour diagrams are presented in Figures 3 through 5 for data obtained on 12/06/89, 4/09/90 and 7/11/90, respectively. The groundwater flow pattern remains essentially unchanged between the three sets of measurements, with the principal groundwater flow direction changing from south, at the north end of the site, to southeast in the pipeline vicinity. Fluctuations in static water level were generally less than 0.5 foot between seasonal measurements. A maximum groundwater level response of approximately 0.3 foot was reported in the Phase I RI for a 10.1-foot tidal change.

A hydrograph of well MW-3 showing seasonal product and groundwater elevation measurements is shown in Figure 6. The maximum seasonal fluctuation measured to date in MW-3 is approximately 0.8 foot, although no compensation was made for tidal influence in these measurements.

The product thickness in well MW-3 shows some variation with tidal changes. Figure 7 presents the variation in product thickness in well MW-3 measured during a 24-hour period and indicates that the maximum product thickness is obtained during low tide.

Water level measurements obtained through a stilling well in Lake Jacobs over a 24-hour period are also shown in Figure 7. The tidal influence on Lake Jacobs was negligible with a maximum flux of 0.05 foot. The absence of tidal influence on Lake Jacobs and its separation from tidally influenced well MW-3 by a concrete retaining wall, indicate poor hydraulic communication between the groundwater in the spill area and Lake Jacobs.

AQUIFER TEST

A pump test was performed to investigate the hydraulic properties of the shallow aquifer at Terminal 91, immediately west of Lake Jacobs. The pump test was performed for a 24-hour period with well MW-6 as the pumping well (Figure 2). The purpose of the pump test was to develop sizing specifications for an interim product recovery system and investigate the capture zone of the proposed extraction well. Details of the tests are presented below.

Pump Test Methodology

Monitoring well MW-6 was pumped for 24 hours on April 9-10, 1990 using an above ground centrifugal pump. The average discharge rate, measured volumetrically, during the duration of the pump test was 0.3 gallon per minute (gpm) with a drawdown of approximately 4 feet. Water levels in the pumped well MW-6 and in observation wells MW-2 and MW-3 were measured with a pressure transducer to the nearest 0.01 foot. Periodic hand measurements made with an electrical sounding device were used for backup purposes. A Terra-8 data-logger was programmed to collect changes in water level elevation measured by

the pressure transducers at preset time intervals during the duration of the pump test in all three wells. Static groundwater levels were measured in all eight wells in the monitoring well network and in Lake Jacobs prior to the start of the pump test. Groundwater levels were measured during the period of pumping and for approximately 34 minutes after the pump was turned off.

PUMP TEST ANALYSIS

Drawdown in pumping well MW-6 was plotted on a log-log scale against time (Figure 8). The static water level in this well was 12.63 feet below ground surface. The well has a total depth of approximately 17 feet and is screened from approximately 7 to 17 feet below ground surface. The drawdown curve for this well, shown in Figure 8, flattens with a drawdown of approximately 4 feet. Analysis of this curve was hindered by tidal fluctuations and suspected well efficiency problems due to the small diameter, 2-inch well.

Extended drawdown minus recovery was plotted against time since pumping had stopped on a log-log format for observation well MW-2 (Figure 9). Of the observation wells, MW-2 demonstrated the greatest amount of drawdown during the test. This plot tends to mimic the shape of the drawdown curve and can be used to calculate aquifer parameters in settings where tidal fluctuations complicate analysis of the direct drawdown data. Log-log curve-matching techniques (Lohman, 1972, Plate 9) were used to calculate the transmissivity of the aquifer. The shape of the curve flattens as time increases, indicating that the cone of depression around the pumped well encounters a recharge zone beyond what would be expected for an ideal homogeneous and isotropic confined aquifer. Match points and calculations used in these analyses are shown on Figure 9.

Transmissivity

Transmissivity (T) is defined as the rate at which water is transmitted through a unit width of the aquifer under a unit hydraulic gradient. The equation used to compute transmissivity is as follows (Lohman, 1972, p. 15):

$$T = \frac{Q}{4\pi s} W(u)$$

where: T = transmissivity in ft^2/min
Q = pumping rate (0.30 gpm)
s = drawdown at match point
W(u) = 1.0

The hydraulic conductivity can be computed from the following relationship:

$$K = T/b$$

where: K = permeability in ft/min
T = transmissivity (see above)
b = saturated screened interval

The analysis indicates an aquifer transmissivity of 1163 gallons per day per foot (0.11 ft^2/min). Using an aquifer thickness equivalent to the saturated screened interval of 7.85 feet yields a permeability value of 0.01 ft/min or 5.6×10^{-3} cm/sec.

Storage Coefficient

The storage coefficient (S) is defined as the volume of water that an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. The equation used to compute the storage coefficient is as follows (Lohman, 1972, p. 15):

$$S = \frac{4Ttu}{r^2}$$

where: T = transmissivity in ft^2/min
t = time at match point
u = 1.0
r^2 = radius from production well to the observation well in feet

The calculated storage coefficient using a match point time of 0.0475 minute and a radius from the production well (MW-6) to the observation well (MW-2) of 57.3 feet is 6×10^{-6}. The low storage coefficient derived from this pump test suggests that the aquifer behaves as a confined aquifer. Under confined conditions, water in an aquifer is present beneath a confining layer and will

rise above the level of the confining layer when it is breached by drilling. A maximum increase in water level of about 1-1/2 feet was noted between the water level at time of drilling and water level after monitoring well installation.

Radius of Influence

The approximate outer limit of the cone of depression or radius of influence can be calculated by utilizing the Jacob distance-drawdown semi-log graphical method. In this analysis, the drawdown from the observation well is plotted on the vertical (arithmetic) axis and the distance from the production well is plotted on the horizontal (logarithmic) axis.

MW-2 is 57.3 feet from the production well (MW-6) and experienced a drawdown of 0.06 foot immediately prior to the cessation of pumping at 1434.50 minutes after the start of the test. The slope of the cone of depression can be derived from measurements in a single observation well by calculating the change in drawdown through the following relationship:

$$T = \frac{528\ Q}{\Delta s}$$

where: T = transmissivity (1163 gpd/ft)
Q = pumping rate (0.30 gpm)
Δs = change in drawdown per 1 log cycle

Solving for Δs yields a change in drawdown per 1 log cycle of distance of 0.136 foot/distance cycle. The slope of this line is plotted in Figure 10 extending through the distance-drawdown relationship measured in MW-2. The distance, R_o, is the approximate extent of the cone of influence (Figure 10). This analysis suggests that the radius from well MW-6 to the outer extent of the cone of influence is approximately 200 feet. Based on this analysis, a pumping well located in the vicinity of MW-3 will be drawing groundwater from a circular area with a radius of 200 feet from the pumping well. This area is shown on Figure 11. This simplified analysis is based on assumptions of homogeneous, isotropic aquifer material and a flat groundwater gradient;

however, geologic conditions logged during monitoring well installation indicate more complex stratigraphic relationships with lenses of sandy gravel interfingered with finer grained sandy material.

Recharge Zone

As mentioned previously, the shape of the recovery curve shown in Figure 9 is flatter than expected for the case of an ideal aquifer, indicating a recharge zone. Curve matching techniques (Lohman, 1972, Plate 9) indicate that the ratio, K, of the distance to the recharge zone to the distance from the pumping well is 5. This gives a distance of approximately 300 feet to the recharge boundary. One possible recharge boundary may be Lake Jacobs, which lies approximately 50 feet west of the pumping well, although the contrast in tidal fluctuation between Lake Jacobs and groundwater in the project area suggests the hydraulic connection is limited. Other recharge boundaries include lateral thickening of permeable water-bearing strata or leakage from an overlying confining layer.

Maximum Drawdown

Application was made to the Municipality of Metropolitan Seattle (Metro) for sanitary sewer discharge of an estimated average daily disposal of 7,200 gallons or 5 gpm and a maximum daily discharge of 14,400 gallons or 10 gpm. Results of the pump test analysis were applied to the Theim equilibrium equation to estimate maximum drawdown for the average daily discharge of 5 gpm:

$$\sqrt{H^2 - \frac{(\ln R_o/r_w)(Q_w)}{\pi K}} - h$$

where: Q_w = well discharge (5 gpm)
R_o = radius of influence (200 feet)
r_w = well radius (0.5 foot)
H = aquifer thickness (assumed minimum thickness of 12 feet of saturated screen = minimum aquifer thickness; minimum aquifer thickness yields maximum drawdown)
K = hydraulic conductivity (0.01 ft/min; 0.1 gpm/ft^2)
h = saturated aquifer thickness at fully penetrating well

Solving for h in a fully penetrated 12-foot aquifer indicates approximately 7 feet of saturated screen or 5 feet of drawdown. This value is considered a maximum drawdown as 12 feet of saturated screen may only partially penetrate the aquifer. A thicker aquifer would yield less drawdown.

PRODUCT EXTRACTION SYSTEM

Product extraction will be accomplished with an all pneumatic system capable of pumping total fluids from a 4-inch diameter or larger well. The advantage of a pneumatic total fluids pumping system is that it allows for more complete recovery of free product and rapid topside separation of product and water. A large diameter (6-inch) recovery well will be installed immediately adjacent to MW-3. Typical extraction well design is shown in Figure 12. The extraction well will have all headworks enclosed in a subsurface vault box. The vault box will be installed 2 inches above grade to prevent surface water drainage into the box area. Ten feet of spare flexible tubing for the pump control and product transport lines will be coiled up inside the vault box to allow for pump height adjustment. All piping from the well will be routed below grade to the treatment system and housed within a 2-inch schedule 40 conduit as part of a double containment system.

The pump will consist of a pneumatically driven, PVC pulse pump fitted with a top filling inlet such as the pulse pump manufactured by QED Environmental Systems. The pump has an outside diameter of approximately 3 inches and is approximately 4 feet in length. For an estimated maximum drawdown of 5 feet, an equivalent setting for the pump's top fill inlet, and a static depth to product of 9 feet, the base of the pump will be 18 feet below ground surface with a 4-foot buffer of saturated screen beneath the base of the pump.

TOPSIDE SEPARATION

Topside separation will be accomplished with an oil/water separator such as the Coalescing Phase Separator Module, model OPL-10, manufactured by Quantek. The manufacturer's specifications for this separator guarantee an effluent of 15 parts per million (ppm) or less. The efficiency of this unit is such that

it removes oil droplets 20 microns and above. The unit is mounted on a 4-foot stand with gravity flow of free product into a double-contained product storage tank. The product storage tank as well as the oil/water separator are equipped with a high level switch that allows for complete system shutdown should high levels of product build up.

Treated effluent will be routed to a 12-inch diameter standpipe. The discharge from the standpipe will be routed to a sanitary sewer via a 3-inch diameter schedule 40 PVC discharge line sloped at a 3 percent grade. A lower explosive limit (LEL) sensor will be fitted to the standpipe to monitor any buildup of explosive gases. The draft Metro permit requires that no two successive LEL sensor readings exceed 5 percent of the LEL and no single reading exceed 10 percent. The LEL sensor is designed so that complete system shutdown will occur at the 5 percent LEL in accordance with the draft Metro permit.

The manhole designated for discharge to the sanitary sewer is shown on Drawing 3, Interim Groundwater Extraction and Treatment System, Converse GES, June 21, 1990. Based on our July 5, 1990 meeting with Metro, it is our understanding that the treated discharge will enter a Port of Seattle sanitary sewer, pass through a Port-operated lift station, continue through the Port sewer into a City of Seattle lift station, through a short segment of City of Seattle sanitary sewer line and finally into the Metro sewer. Billing of the lift stations will be coordinated with Port of Seattle.

A draft Industrial Waste Discharge permit for disposal of treated effluent was issued by Metro on July 20, 1990. A copy of the draft permit is included in Appendix B. This permit requires effluent monitoring for priority pollutants metals; volatile and semivolatile compounds; fats, oil and grease (FOG); cyanide; pH; temperature; soluble sulfide and atmospheric sulfide. Influent sampling will occur in addition to the required Metro effluent monitoring to monitor the efficiency of the treatment system. Lastly, groundwater samples from monitoring wells adjacent to the project area (MW-3, MW-2, MW-6 & MW-102) will be sampled on a quarterly basis and analyzed for total petroleum hydrocarbons by EPA method 418.1 to monitor the effectiveness of the cleanup.

As part of the Metro discharge permit application process, monitoring well MW-3 was sampled and submitted to Laucks Testing Laboratories for a priority pollutant scan and analysis of soluble sulfide. Results of these analyses are summarized in Table 1 and laboratory reported analytical results are presented in Appendix A. Low levels of inorganic and polycyclic aromatic hydrocarbons (PAHs) were detected. Volatile organic compounds, pesticides, PCBs, and soluble sulfide were less than the detection limit.

REFERENCES

Converse Consultants NW, July 5, 1990, Phase I Remedial Investigation, Terminal 91 Facility, Seattle, Washington, 89-45527-02.

Hart Crowser, Sept. 11, 1989, Oil Seepage Investigation, Short Fill Pond, Terminal 91, J-2500.

Lohman, S.W., 1979, Groundwater Hydraulics, Geological Survey Professional Paper 708, 70 pp.

TABLE 1

ANALYTICAL RESULTS OF PRIORITY POLLUTANT SCAN ON MW-3
Pacific Northern Oil

Inorganics

Chromium	2 µg/l	1 µg/l found in blank
Copper	2 µg/l	2 µg/l found in blank
Total Cyanide	9 µg/l	
Total Phenol	130 µg/l	
Zinc	7 µg/l	4 µg/l found in blank

Volatile Organics

All compounds below detection limit (refer to Appendix A)

Semivolatile Organics

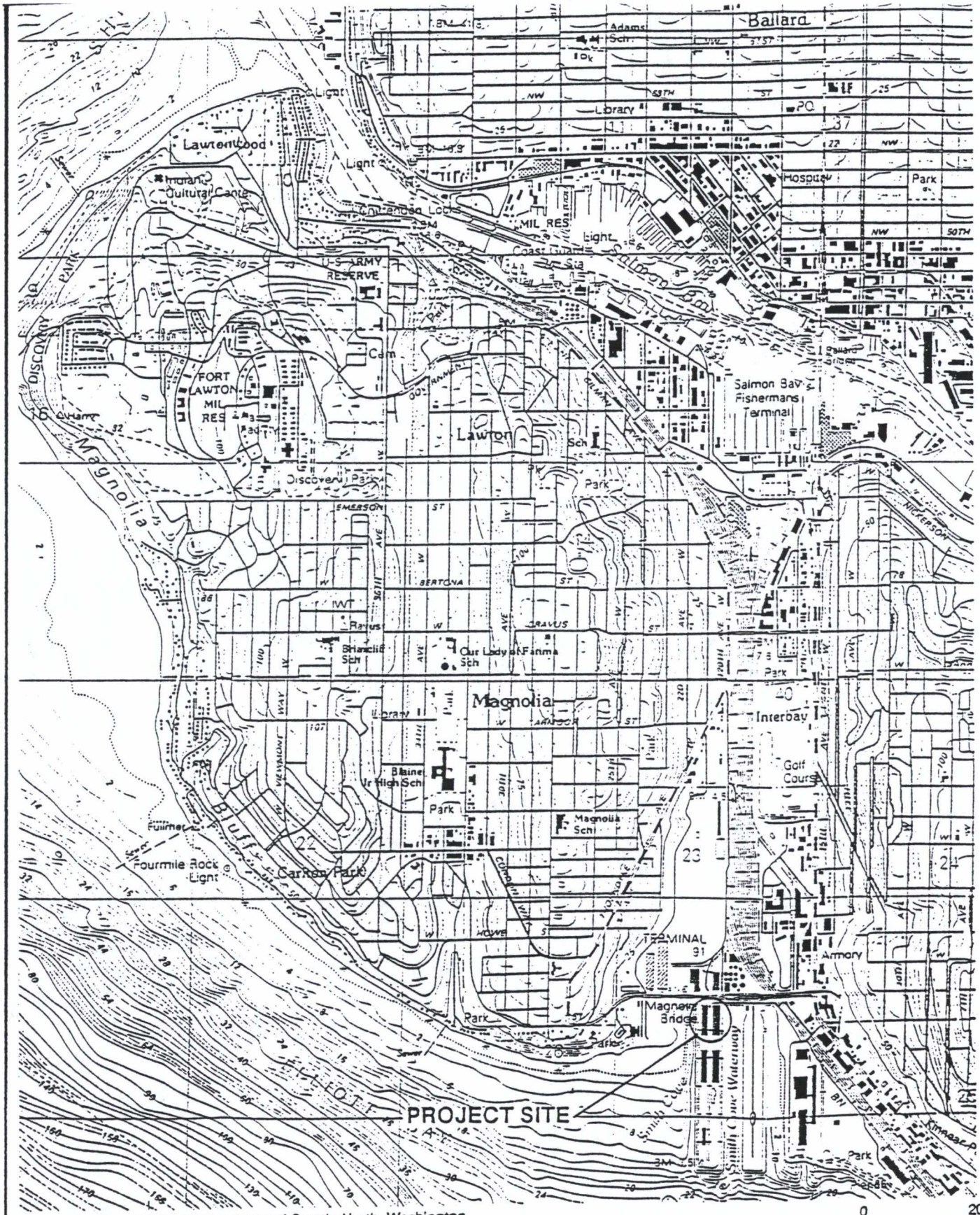
2-Methylnaphthalene	240 µg/l
Acenaphthene	36 µg/l
Dibenzofuran	30 µg/l
Fluorene	96 µg/l
Phenanthrene	100 µg/l
Fluoranthene	22 µg/l

Organochlorine Pesticides and PCBs

All compounds below detection limit (refer to Appendix A)

Soluble Sulfide

<100 µg/l

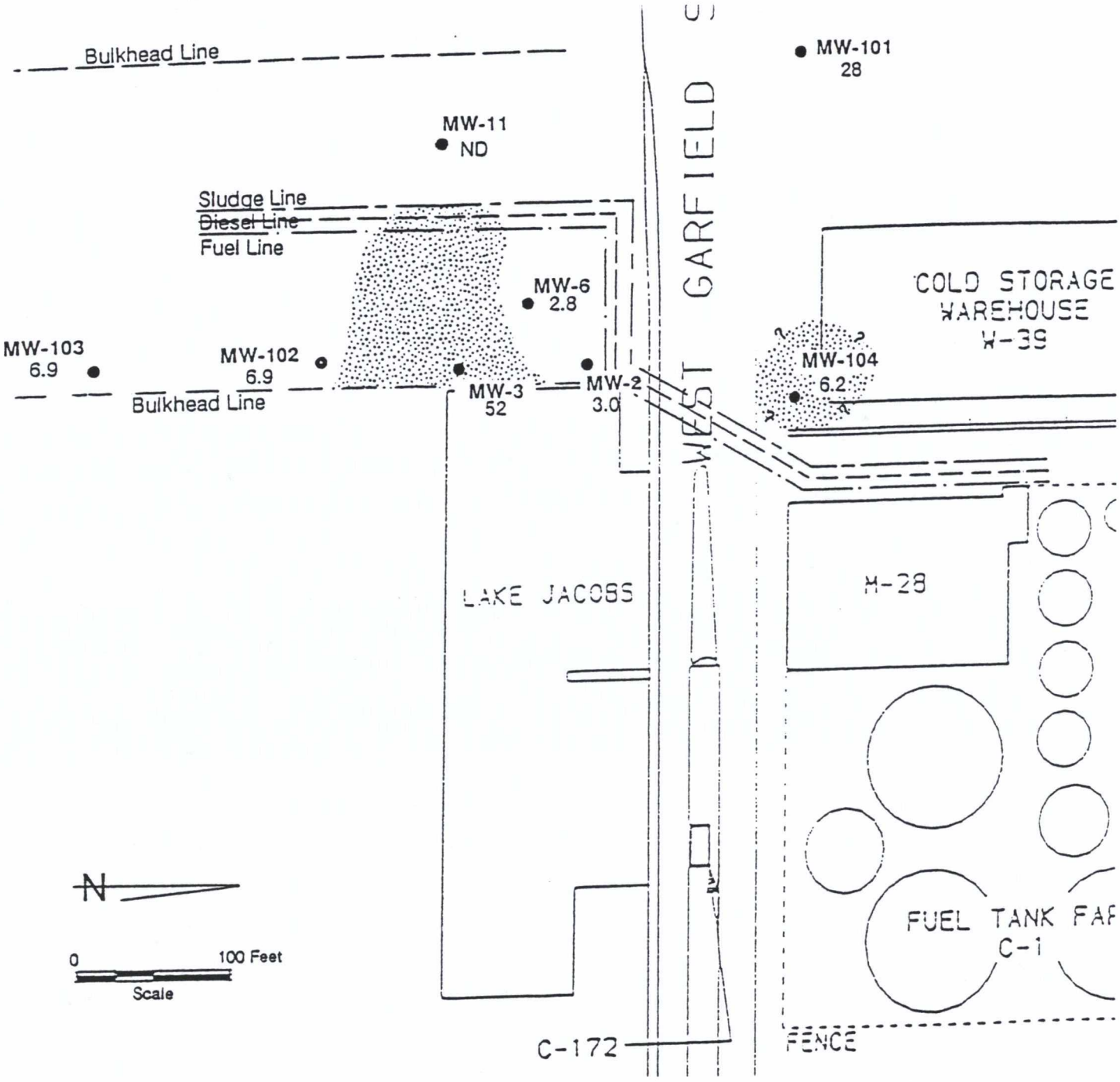


REFERENCE: USGS/NOAA 7-1/2'x15' Seattle North, Washington.

Figure No. 1
PROJECT LOCATION MAP
Pacific Northern Oil - Terminal 91

JULY 1990

Converse GES



LEGEND:

MW-3 ● Monitoring well

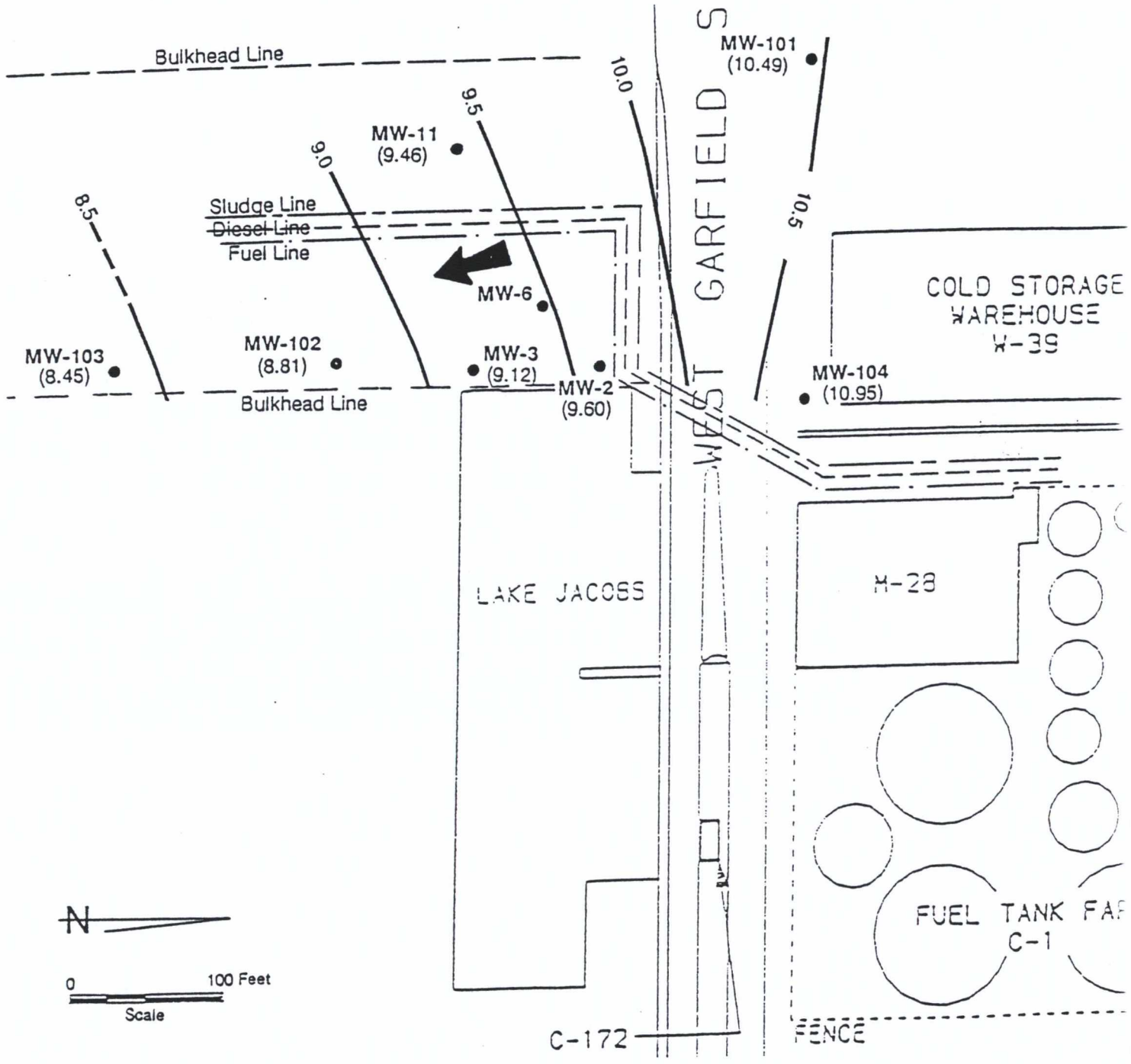
52 TPH in groundwater in mg/l (ppm) sampled Dec. 6, 7, 1989 ND - Not detected

Estimated extent of floating hydrocarbons in vicinity of MW-3

Figure No. 2
ESTIMATED EXTENT OF FLOATING HYDROCARBONS IN VICINITY OF MW-3 AND TPH VALUES IN GROUNDWATER
Pacific Northern Oil - Terminal 91

JULY 1990

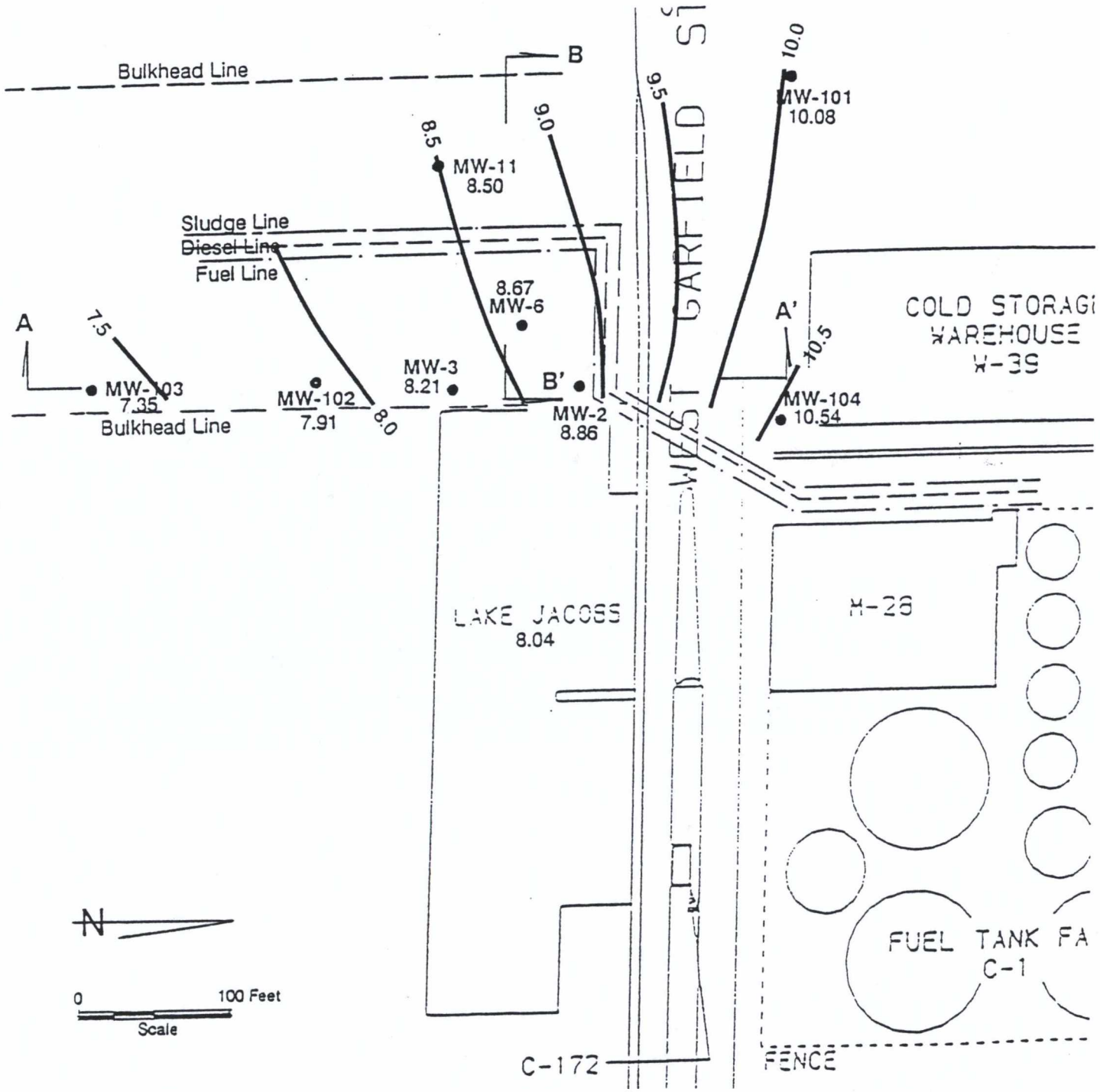
Converse GES



LEGEND:

MW-2 ● Monitoring well
(10.49) (groundwater elevation)

Figure No. 3
GROUNDWATER LEVELS - DEC. 6, 1989; 11:30 a.m
Pacific Northern Oil - Terminal 91



LEGEND:

MW-3 ● Monitoring well

Location of cross section

Figure No. 4
GROUNDWATER LEVELS - APRIL 9, 1990; 11:30 a.m
Pacific Northern Oil - Terminal 91

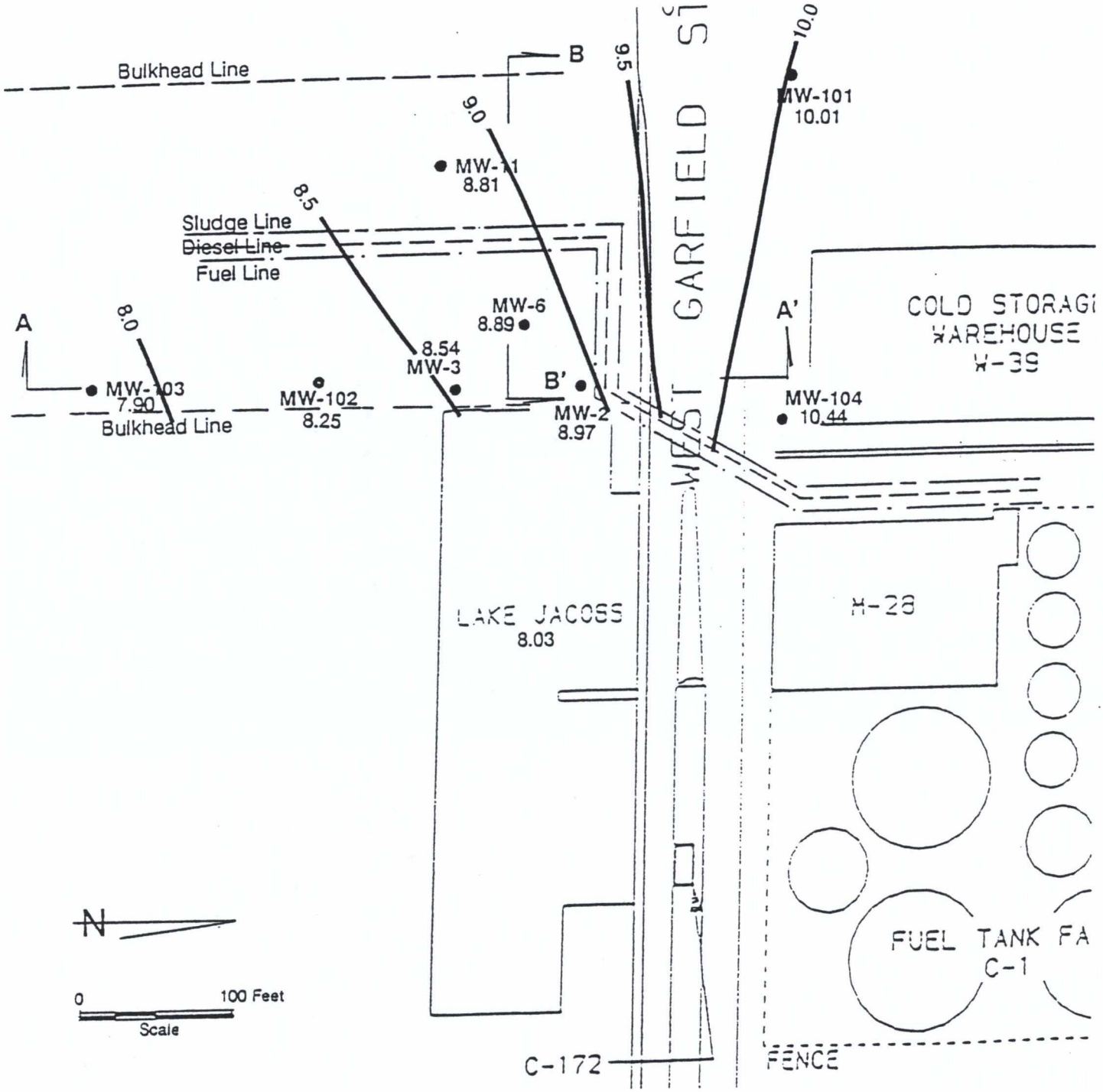
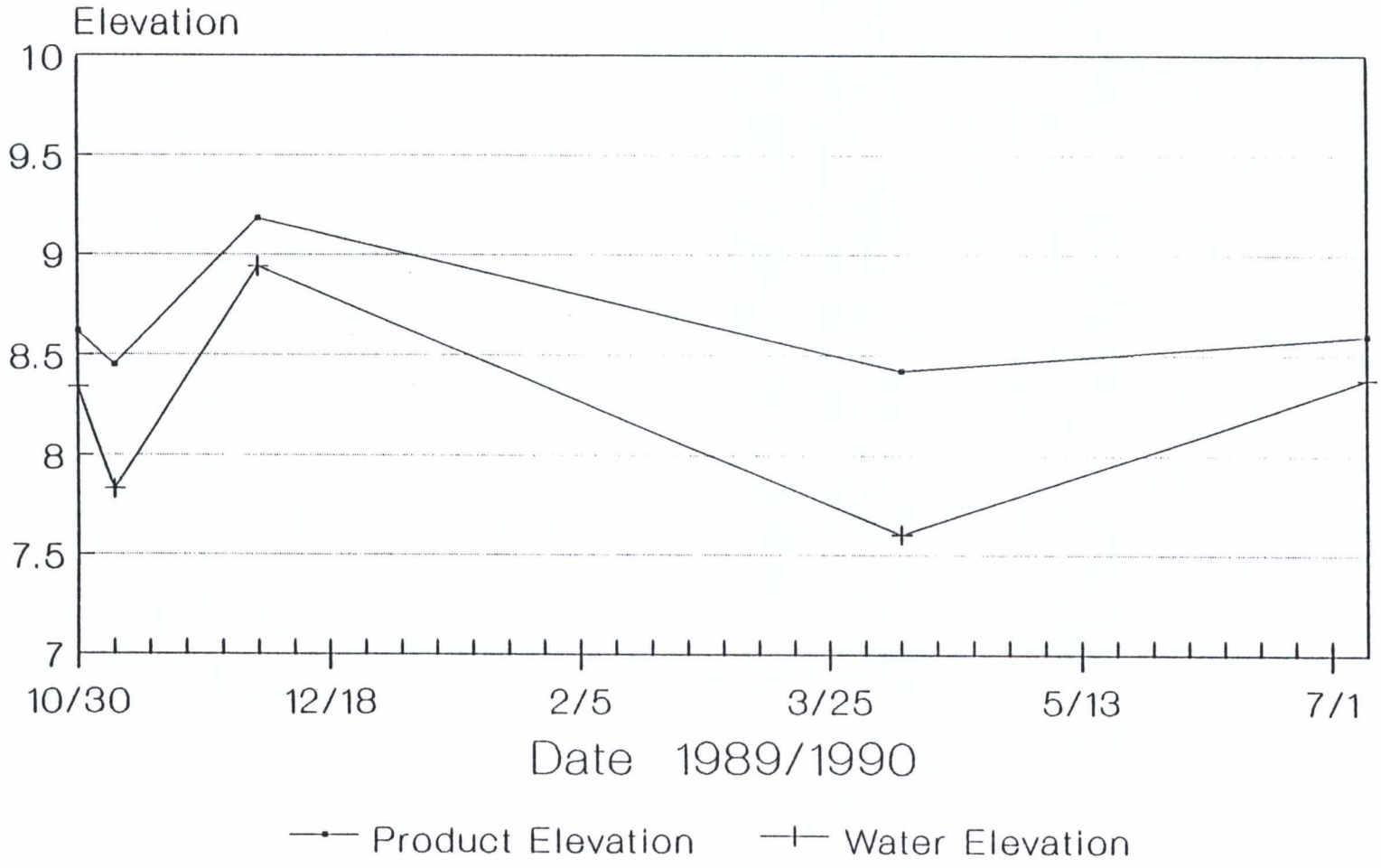


Figure No. 5
GROUNDWATER LEVELS - JULY 11, 1990; 10:00 a.m.
Pacific Northern Oil - Terminal 91

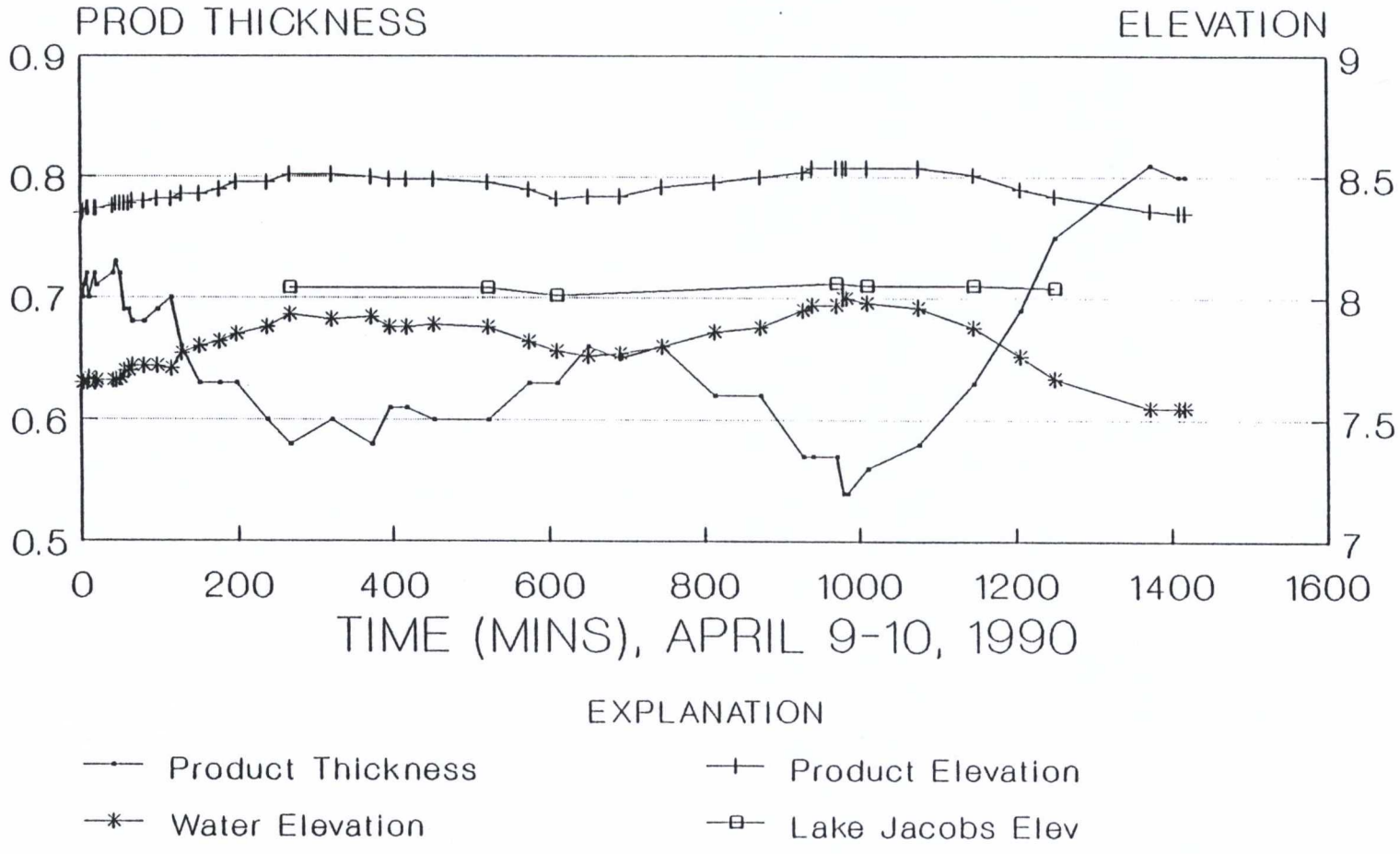
MW-3 HYDROGRAPH
Pacific Northern Oil



Seasonal Product/Static Water Level Elev

Figure No. 6
MW-3 HYDROGRAPH
Pacific Northern Oil - Terminal 91

MW-3 AND LAKE JACOBS HYDROGRAPH
PACIFIC NORTHERN OIL



PRODUCT THICKNESS AND PRODUCT/WATER ELEV

Figure No. 7
PRODUCT THICKNESS
Pacific Northern Oil - Terminal 91

PACIFIC NORTHERN OIL
PUMP TEST APRIL 9 - 10, 1990
MW-6 DRAWDOWN LOG-LOG PLOT

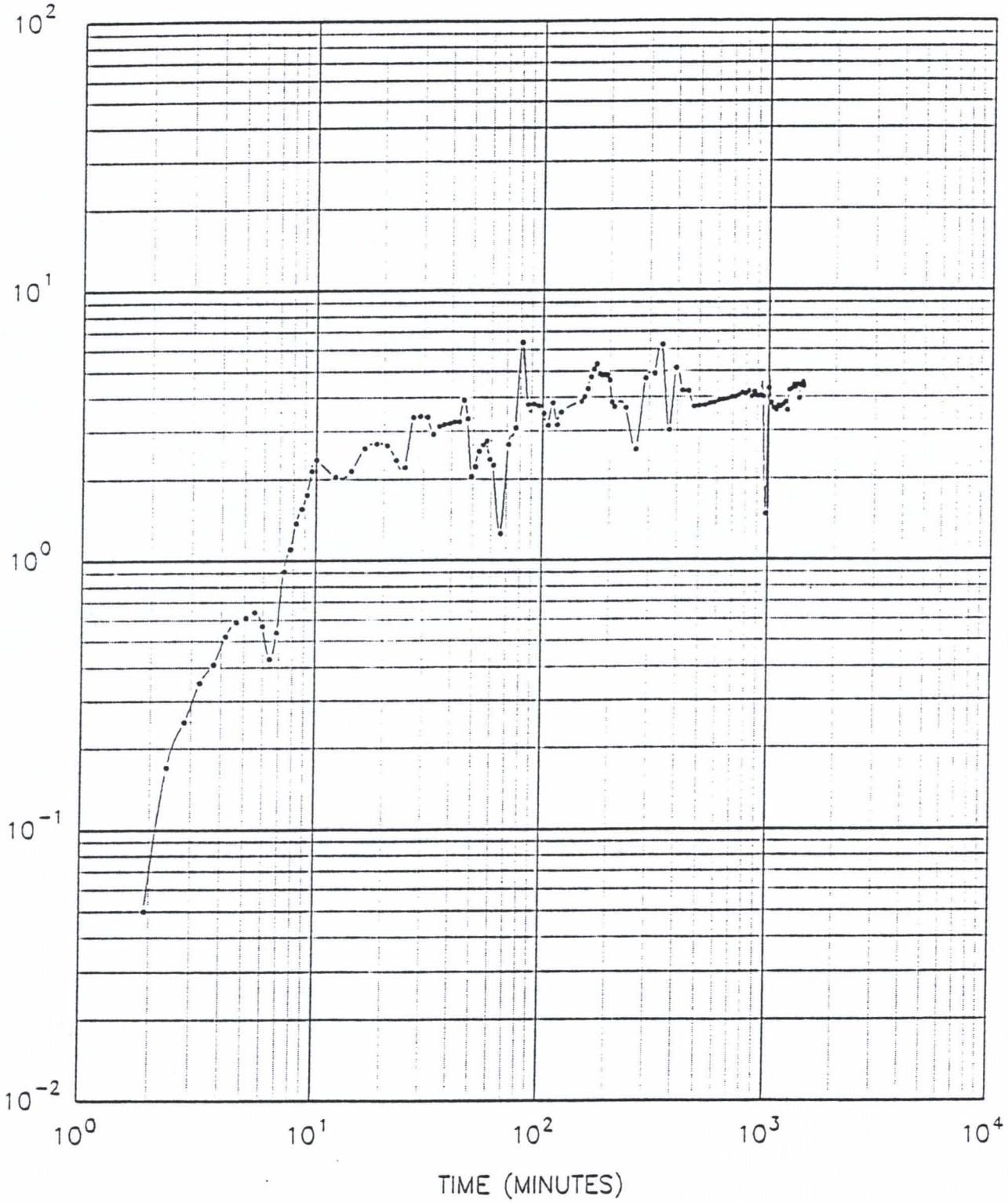
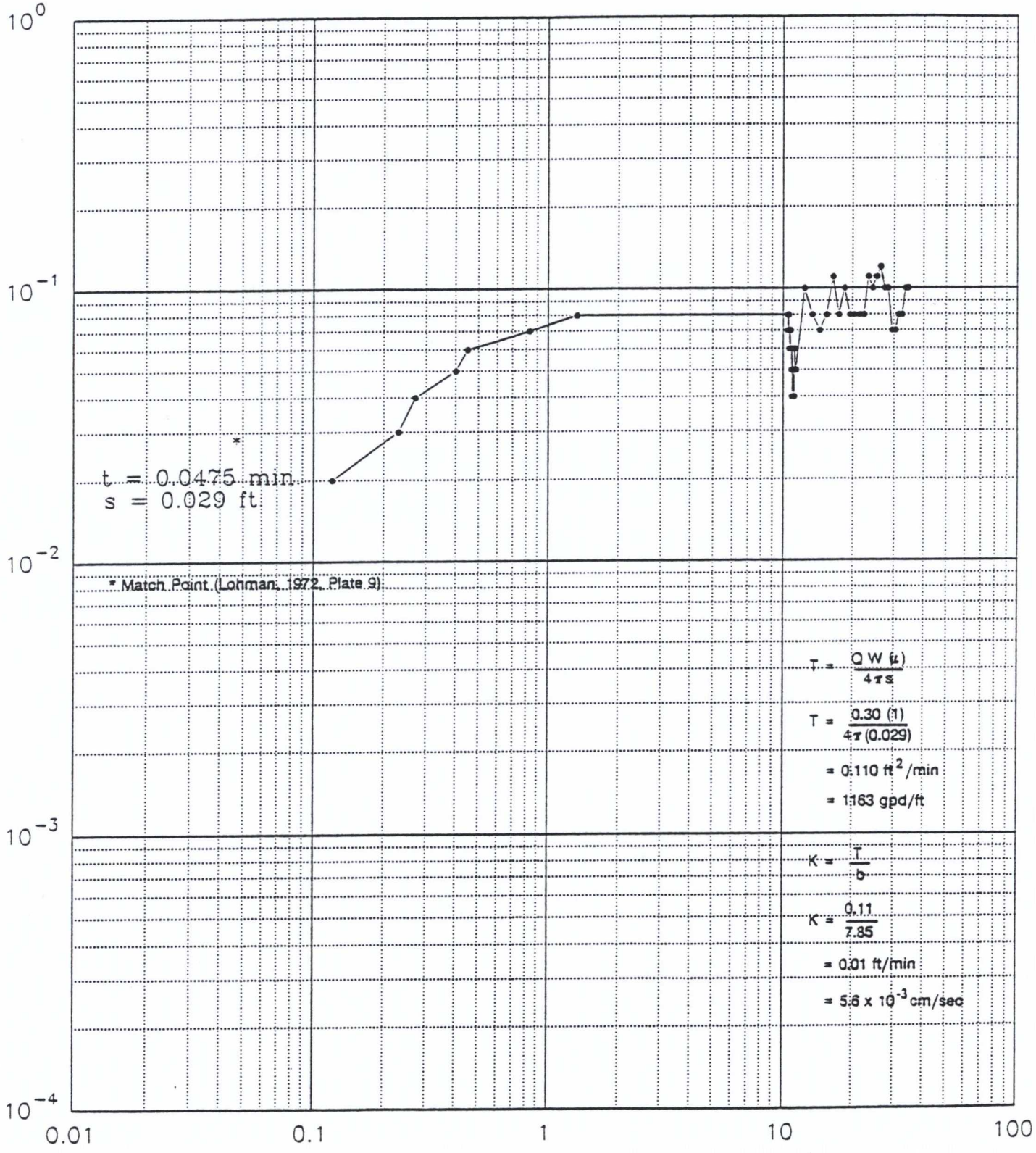


Figure No. 8
MW-6 DRAWDOWN LOG-LOG PLOT
Pacific Northern Oil

PACIFIC NORTHERN OIL
PUMP TEST APRIL 9 - 10, 1990
MW-2 RECOVERY DATA LOG-LOG PLOT



RECOVERY, FEET

TIME SINCE PUMPING STOPPED IN MINUTES

Figure No. 9
MW-2 RECOVERY DATA LOG-LOG PLO
Pacific Northern Oil

PACIFIC NORTHERN OIL

PUMP TEST APRIL 9–10. 1990

DISTANCE - DRAWDOWN SEMILOG PLOT

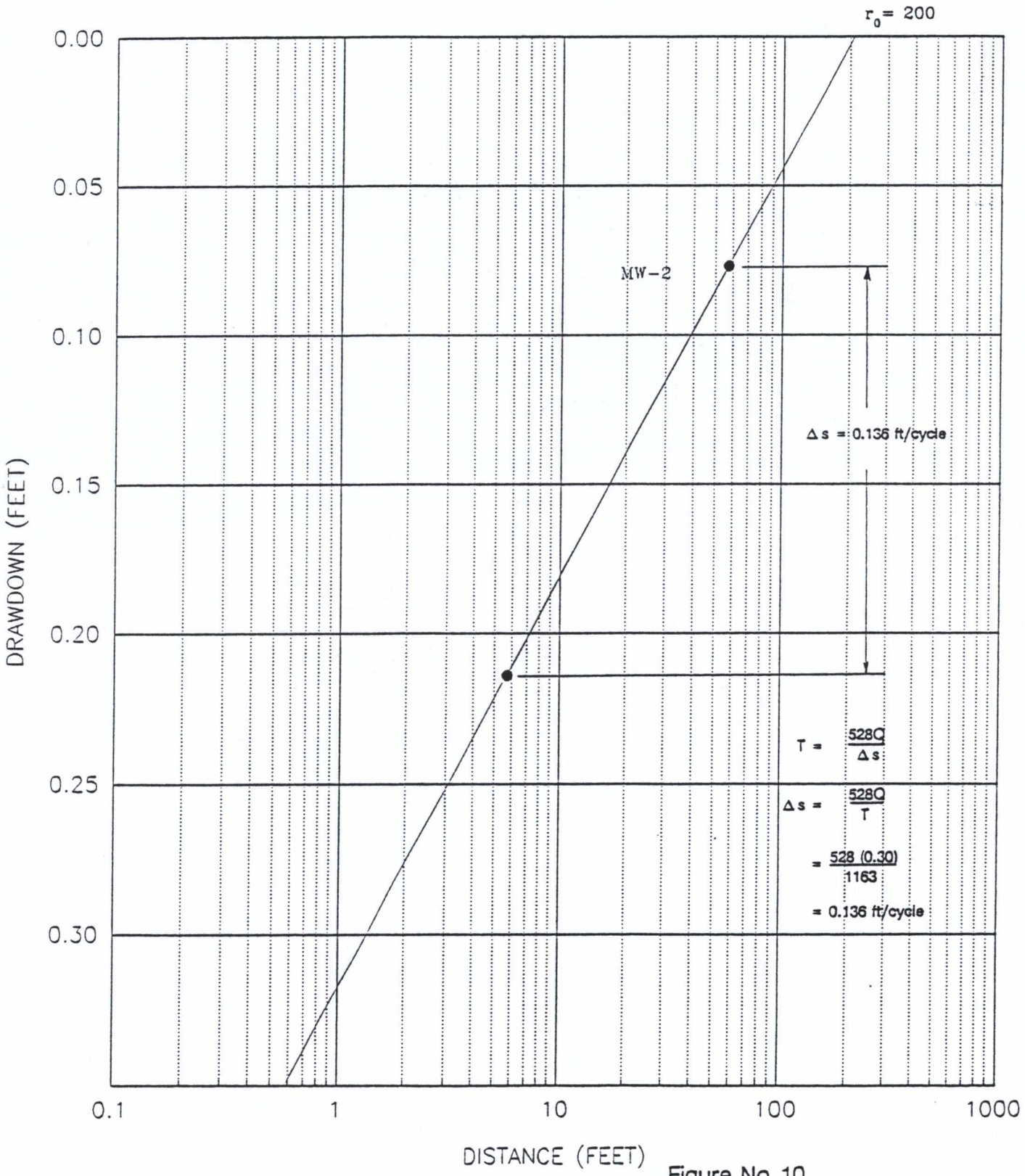
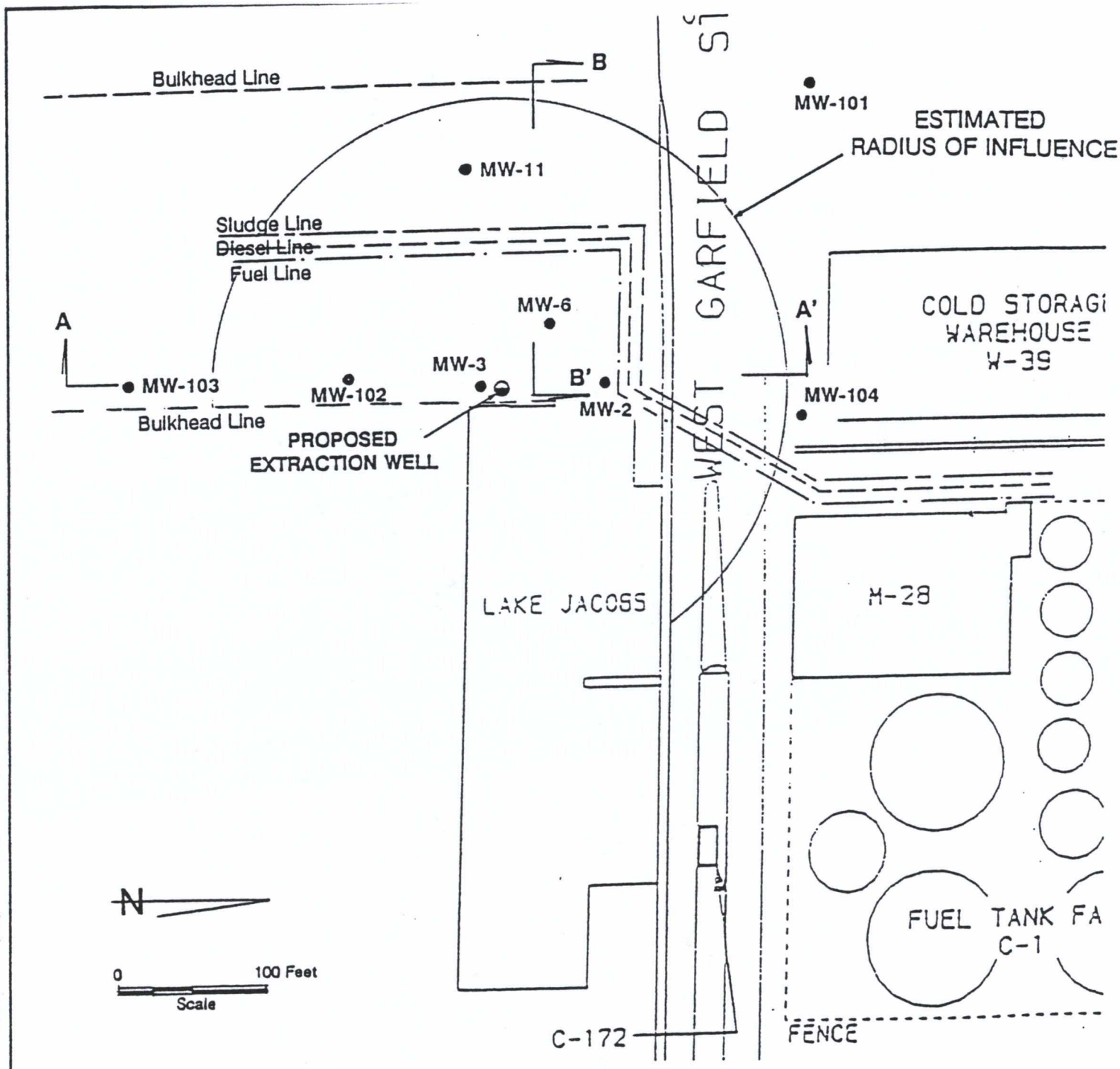


Figure No. 10
DISTANCE-DRAWDOWN SEMILOG PLC
Pacific Northern Oil



LEGEND:

MW-3 ● Monitoring well

Location of cross section

Figure No. 11
RADIUS OF INFLUENCE
Pacific Northern Oil - Terminal 91

TYPICAL 6-INCH MONITORING WELL INSTALLATION

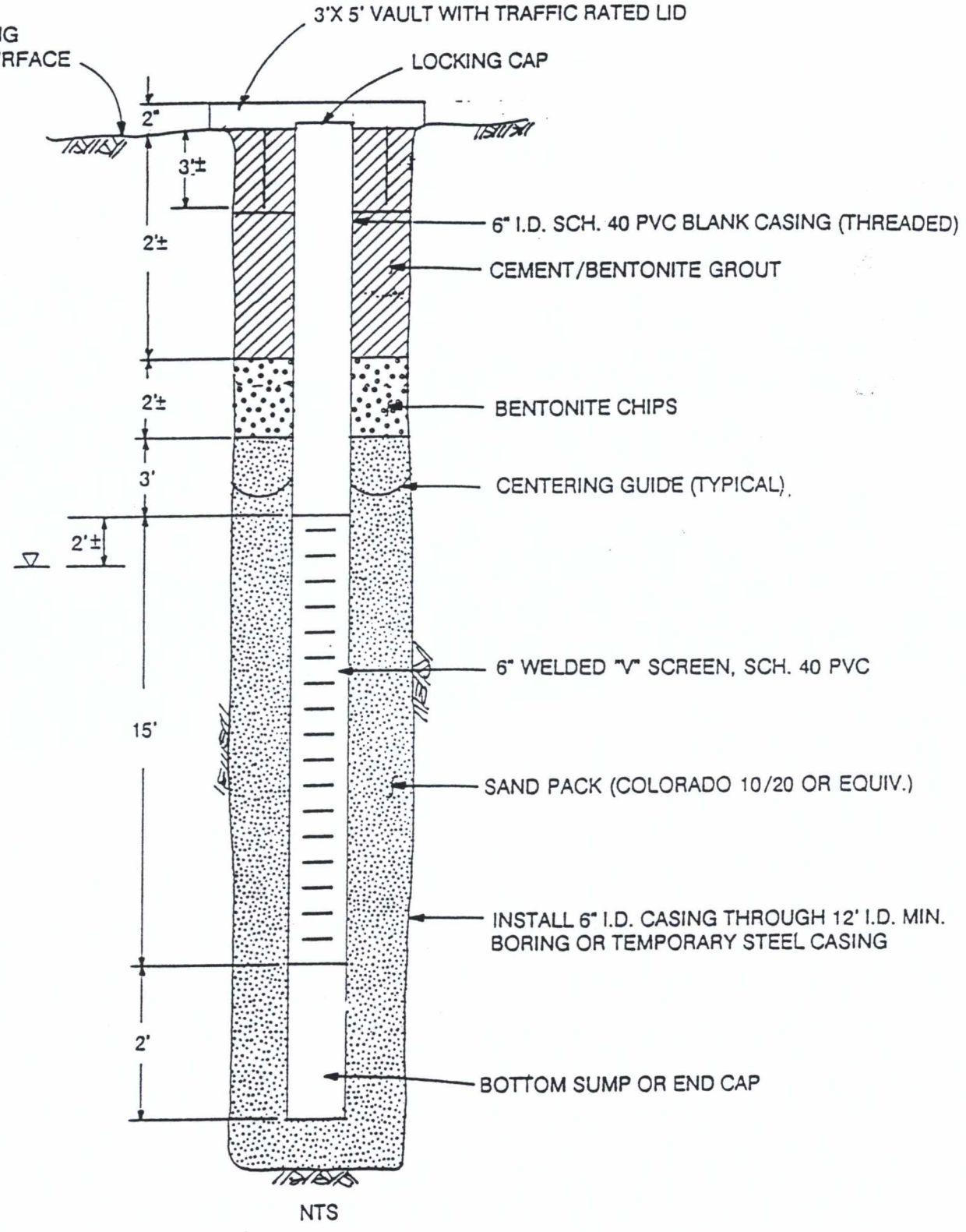


Figure No. 12
INTERIM PRODUCT EXTRACTION WELL
Pacific Northern Oil - Terminal 91

Appendix

APPENDIX A

LABORATORY-REPORTED ANALYTICAL RESULTS

Laucks 82 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063

Chemistry, Microbiology, and Technical Services

CLIENT: Converse Consultants NW
3131 Elliott Ave West, #550
Seattle, WA 98121

ATTN : Erick Miller

Work ID : Pacific Northern Oil
Taken By : Client
Transported by: Hand Delivered
Type : Water

Certificate of Analysis

Work Order# : 90-05-133
DATE RECEIVED : 05/07/90
DATE OF REPORT: 05/30/90
CLIENT JOB ID : Project No. 89-45527-03

SAMPLE IDENTIFICATION:

	Sample Description	Collection Date
01	Well MW-3	05/07/90 02:30
02	Method Blank	N/A

Unless otherwise instructed all samples will be discarded on 07/12/90

Respectfully submitted,
Laucks Testing Laboratories, Inc.

J. M. Ovens

Laucks 82 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063

Chemistry, Microbiology, and Technical Services

USING OUR NEW REPORTS

Laucks has installed an electronic Laboratory Information Management System which now produces both our reports and invoices. The following information and definitions will help you use the new formats; and we encourage you to call us if your questions are not answered here.

SAMPLE IDENTIFICATION - Sample IDs are recorded as they appear on your sample containers or chain-of-custody documents. One "sample" may have several "fractions" (different analytical tasks), so a sample's ID may appear more than once on the cover page. You may notice "extra" samples, not submitted by you. These were added by Laucks to allow our electronic system to accommodate quality control analyses, such as method blanks and matrix spikes.

TEST RESULTS - Analyses which result in a single data point are shown in alphabetical order in the body of the report. Tests which yield multiple results are generally reported on separate pages, on a sample-by-sample basis.

MEASUREMENT UNITS - The reporting units are shown to the right of the analyte name. In the event that a different unit was more appropriate to a specific sample, that exception is shown immediately beneath the test result. Units commonly employed are mg/kg (solids) or mg/L (liquids), comparable to parts per million; ug/kg (solids) or ug/L (liquids), comparable to parts per billion; and percent (%).

METHODS OF ANALYSIS - The EPA or Standard Methods method number is now shown in parentheses after the analyte name; or, for analyses which yield multiple data points, in the header information on the individual report page.

ABBREVIATIONS - Several abbreviations can appear in our reports. The most commonly employed abbreviations are:

U : The analyte of interest was not detected, to the limit of detection indicated.

B : The analyte of interest was detected in the method blank associated with the sample, as well as in the sample itself.

J : The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.

Laucks 82 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063

Chemistry, Microbiology, and Technical Services

T : The flagged values represent the SUM of two co-eluting compounds. The SUM of these two values is shown as though it were a result for each of them, but in fact it represents the total and the two figures should not be further added together.

D : The value reported derives from analysis of a diluted sample or sample extract.

SDL : Sample Detection Limit. The SDL can vary from sample to sample, depending on sample size, matrix interferences, moisture content and other sample-specific conditions.

MDL : Method Detection Limit.

CRDL : Contract Recommended Detection Limit, usually the limit of detection specified at your request.

DB : Dry Basis. The value reported has been back-calculated to normalize for the moisture content of the sample.

AR : As-Received. The value has NOT been normalized for moisture.

Other abbreviations, used in special applications, are defined where they appear (as in the Surrogate Recovery Appendix).

DISPOSAL DATE - Our reports now include the date on which we will dispose of your samples. (In limited instances, we may require that the samples be returned to your custody.) If you wish to have the samples back, or would like to have them stored for a longer period, please notify us before the disposal date.

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CLIENT : Converse Consultants NW

Certificate of Analysis

Work Order # 90-05-133

TESTS PERFORMED AND RESULTS:

Analyte	Units	01
Antimony (Method 204.2)	ug/L	5.0 U
Arsenic (Method 206.3)	ug/L	5. U
Beryllium (Method 6010)	ug/L	1. U
Cadmium (Method 6010)	ug/L	1. U
Chromium (Method 6010)	ug/L	2.
Copper (Method 6010)	ug/L	2.
Cyanide, Total (335.3)	mg/L	0.009
Lead (Method 239.2)	ug/L	10.0 U
Mercury (Method 245.1)	ug/L	1. U
Nickel (Method 6010)	ug/L	2. U
Selenium (Method 270.3)	ug/L	5. U
Silver (Method 6010)	ug/L	1. U
Thallium (Method 279.2)	ug/L	5.0 U
Total Phenol	mg/L	0.13
Zinc (Method 6010)	ug/L	7.

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REPORT ON SAMPLE: 9005133-01A
Client Sample ID: Well MW-3

Date Received : 05/07/90
Date Extracted : N/A
Test Code : LXTCVW

Collection Date : 05/07/90
Date Analyzed : 05/08/90
Test Method : SW 8240

Compound	Result (ug/L)	SDL (ug/L)	Compound	Result (ug/L)	SDL (ug/L)
Chloromethane	5 U	5	Bromodichloromethane	5 U	5
Bromomethane	5 U	5	1,2-Dichloropropane	5 U	5
Vinyl chloride	5 U	5	Trichloroethene	5 U	5
Chloroethane	15 U	15	Benzene	5 U	5
Methylene chloride	5 U	5	Dibromochloromethane	15 U	15
Acetone	25 U	25	1,1,2-Trichloroethane	5 U	5
Carbon disulfide	5 U	5	Bromoform	5 U	5
1,1-Dichloroethene	5 U	5	4-Methyl-2-pentanone	15 U	15
1,1-Dichloroethane	5 U	5	2-Hexanone	15 U	15
trans-1,2-Dichloroethene	5 U	5	1,1,2,2-Tetrachloroethane	15 U	15
cis-1,2-Dichloroethene	5 U	5	Tetrachloroethene	5 U	5
Total 1,2-Dichloroethene	5 U	5	Toluene	5 U	5
Chloroform	5 U	5	Chlorobenzene	15 U	15
2-Butanone	15 U	15	trans-1,3-Dichloropropene	15 U	15
1,2-Dichloroethane	5 U	5	Ethylbenzene	5 U	5
1,1,1-Trichloroethane	5 U	5	cis-1,3-Dichloropropene	15 U	15
Carbon tetrachloride	5 U	5	Styrene	5 U	5
Vinyl acetate	5 U	5	Total Xylene	5 U	5

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	95	79	116
Toluene d8	103	85	112
p-Bromofluorobenzene	104	82	114

* Surrogate recovery is outside of control limits. See comments.

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REPORT ON SAMPLE: 9005133-01A
Client Sample ID: Well MW-3

Date Received : 05/07/90
Date Extracted : 05/09/90
Test Code : LXTCSW

Collection Date : 05/07/90
Date Analyzed : 05/26/90
Test Method : SW8270
Extraction Method : SW3510

Compound	Result (ug/L)		SDL (ug/L)
Phenol	20	U	20
Aniline	100	U	100
Bis(2-chloroethyl)ether	20	U	20
2-Chlorophenol	20	U	20
1,3-Dichlorobenzene	20	U	20
1,4-Dichlorobenzene	20	U	20
Benzyl alcohol	20	U	20
1,2-Dichlorobenzene	20	U	20
2-Methylphenol	20	U	20
Bis(2-chloroisopropyl)ether	20	U	20
4-Methylphenol	20	U	20
N-Nitroso-di-n-propylamine	20	U	20
Hexachloroethane	40	U	40
Nitrobenzene	20	U	20
Isophorone	20	U	20
2-Nitrophenol	40	U	40
2,4-Dimethylphenol	20	U	20
Benzoic acid	500	U	500
Bis(2-chloroethoxy)methane	20	U	20
2,4-Dichlorophenol	40	U	40
1,2,4-Trichlorobenzene	20	U	20
Naphthalene	40	U	40
4-Chloroaniline	20	U	20
Hexachlorobutadiene	20	U	20
4-Chloro-3-methylphenol	40	U	40
2-Methylnaphthalene	240		20
Hexachlorocyclopentadiene	40	U	40
2,4,6-Trichlorophenol	40	U	40
2,4,5-Trichlorophenol	40	U	40
2-Chloronaphthalene	20	U	20
2-Nitroaniline	40	U	40
Dimethyl phthalate	20	U	20
Acenaphthylene	20	U	20
2,6-Dinitrotoluene	40	U	40

Compound	Result (ug\L)		SDL (ug/L)
3-Nitroaniline	100	U	100
Acenaphthene	36		20
2,4-Dinitrophenol	200	U	200
4-Nitrophenol	200	U	200
Dibenzofuran	30		20
2,4-Dinitrotoluene	40	U	40
Diethyl phthalate	20	U	20
4-Chlorophenyl phenylether	20	U	20
Fluorene	96		20
4-Nitroaniline	40	U	40
4,6-Dinitro-2-methylphenol	200	U	200
N-Nitrosodiphenylamine	20	U	20
1,2-Diphenylhydrazine	40	U	40
4-Bromophenyl phenylether	40	U	40
Hexachlorobenzene	40	U	40
Pentachlorophenol	200	U	200
Phenanthrene	100		20
Anthracene	20	U	20
Di-n-butyl phthalate	20	U	20
Fluoranthene	22		20
Pyrene	20	U	20
Benzidine	500	U	500
Butylbenzylphthalate	20	U	20
3,3'-Dichlorobenzidine	200	U	200
Benzo(a)anthracene	20	U	20
Chrysene	20	U	20
Bis(2-ethylhexyl)phthalate	20	U	20
Di-n-octyl phthalate	20	U	20
Benzo(b)fluoranthene	40	U	40
Benzo(k)fluoranthene	40	U	40
Benzo(a)pyrene	40	U	40
Indeno(1,2,3-cd)pyrene	40	U	40
Dibenzo(a,h)anthracene	40	U	40
Benzo(g,h,i)perylene	40	U	40

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REPORT ON SAMPLE: 9005133-01A
Client Sample ID: Well MW-3

Date Received : 05/07/90
Date Extracted : 05/09/90
Test Code : 8080

Collection Date : 05/07/90
Date Analyzed : N/A
Test Method : SW 8080
Extraction Method : 3510PX

Report Units : ug/L

Compound	Result	SDL	Analysis Date	Confirmation Date
Alpha-BHC.....	0.1 U	0.1	05/16/90	05/16/90
Beta-BHC.....	0.1 U	0.1	05/16/90	05/16/90
Delta-BHC.....	0.1 U	0.1	05/16/90	05/16/90
Gamma-BHC.....	0.1 U	0.1	05/16/90	05/16/90
Heptachlor.....	0.1 U	0.1	05/16/90	05/16/90
Aldrin.....	0.1 U	0.1	05/16/90	05/16/90
Heptachlor Epoxide..	0.1 U	0.1	05/16/90	05/16/90
Endosulfan I.....	0.1 U	0.1	05/16/90	05/16/90
Dieldrin.....	0.1 U	0.1	05/16/90	05/16/90
4,4'-DDE.....	0.1 U	0.1	05/16/90	05/16/90
Endrin.....	0.1 U	0.1	05/16/90	05/16/90
Endosulfan II.....	0.1 U	0.1	05/16/90	05/16/90
4,4'-DDD.....	0.1 U	0.1	05/16/90	05/16/90
Endosulfan Sulfate..	0.1 U	0.1	05/16/90	05/16/90
4,4'-DDT.....	0.1 U	0.1	05/16/90	05/16/90
Methoxychlor.....	0.5 U	0.5	05/16/90	05/16/90
Endrin Ketone.....	0.1 U	0.1	05/16/90	05/16/90
Alpha Chlordane.....	0.5 U	0.5	05/16/90	05/16/90
Gamma Chlordane.....	0.5 U	0.5	05/16/90	05/16/90
Toxaphene.....	1.0 U	1.0	05/16/90	05/16/90
Aroclor-1016.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1221.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1232.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1242.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1248.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1254.....	1.0 U	1.0	05/16/90	05/16/90
Aroclor-1260.....	1.0 U	1.0	05/16/90	05/16/90

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Surrogate recovery report for sample 9005133-01A

Surrogate	Percent Recovery	Limits: Min.	Max.
Dibutylchlorendate.....	47	43	152
Isodrin.....	65	32	96

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REPORT ON WORK ORDER 9005133 PREPARATION BLANKS

Test : **Mercury (Method 245.1)**
Blank Name : B0511HGW01 Preparation Date: 05/11/90
Conc Found : 1.000 U Control Limit : 2.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

Test : **Arsenic (Method 206.3)**
Blank Name : B0514HY02 Preparation Date: 05/14/90
Conc Found : 5.000 U Control Limit : 10.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

Test : **Selenium (Method 270.3)**
Blank Name : B0514HY05 Preparation Date: 05/14/90
Conc Found : 5.000 U Control Limit : 10.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

Test : **Beryllium (Method 6010)**
Blank Name : B0516ICP_W01 Preparation Date: 05/16/90
Conc Found : 1.000 U Control Limit : 2.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

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REPORT ON WORK ORDER 9005133 PREPARATION BLANKS

Test : Nickel (Method 6010)
Blank Name : B0516ICP_W01 Preparation Date: 05/16/90
Conc Found : 2.000 U Control Limit : 4.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

Test : Zinc (Method 6010)
Blank Name : B0516ICP_W01 Preparation Date: 05/16/90
Conc Found : 4.000 Control Limit : 5.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

Test : Chromium (Method 6010)
Blank Name : B0516ICP_W01 Preparation Date: 05/16/90
Conc Found : 1.000 Control Limit : 2.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

Test : Silver (Method 6010)
Blank Name : B0516ICP_W01 Preparation Date: 05/16/90
Conc Found : 1.000 U Control Limit : 2.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

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REPORT ON WORK ORDER 9005133 PREPARATION BLANKS

Test : Cadmium (Method 6010)
Blank Name : B0516ICP_W01 Preparation Date: 05/16/90
Conc Found : 1.000 U Control Limit : 2.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

Test : Copper (Method 6010)
Blank Name : B0516ICP_W01 Preparation Date: 05/16/90
Conc Found : 2.000 Control Limit : 2.000
Units : ug/L

This blank and comments, if any, apply to the following sample(s):
1

Test : Cyanide, Total (335.3)
Blank Name : B0518CN_W01 Preparation Date: 05/18/90
Conc Found : 0.005 U Control Limit : 0.010
Units : mg/L

This blank and comments, if any, apply to the following sample(s):
1

Test : Total Phenol
Blank Name : B0524PNL_W01 Preparation Date: 05/24/90
Conc Found : 0.005 U Control Limit : 0.010
Units : mg/L

This blank and comments, if any, apply to the following sample(s):
1

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REPORT ON WORK ORDER 9005133 PREPARATION BLANKS

Test : Antimony (Method 204.2)
Blank Name : B0524ICP_W01 Control Limit : 10.000
Conc Found : 5.000 U
Units : ug/L Preparation Date: 05/24/90

This blank applies to the following samples:
9005133-1

Test : Thallium (Method 279.2)
Blank Name : B0524GF_W01 Preparation Date: 05/24/90
Conc Found : 5.000 U Control Limit : 10.000
Units : ug/L

This blank applies to the following samples:
9005133-1

Test : Lead (Method 239.2)
Blank Name : B0424GF_W01 Preparation Date: 05/24/90
Conc Found : 10.000 U Control Limit : 20.000
Units : ug/L

This blank applies to the following samples:
9005133-1

* = outside control limits
U = analtye not detected

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Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9005133-02A
Client Sample ID: Method Blank

Date Received : 05/07/90
Date Extracted : N/A
Test Code : LXTCVW

Collection Date :
Date Analyzed : 05/08/90
Test Method : SW 8240

Compound	Result (ug/L)	SDL (ug/L)	Compound	Result (ug/L)	SDL (ug/L)
Chloromethane	1 U	1	Bromodichloromethane	1 U	1
Bromomethane	1 U	1	1,2-Dichloropropane	1 U	1
Vinyl chloride	1 U	1	Trichloroethene	1 U	1
Chloroethane	3 U	3	Benzene	1 U	1
Methylene chloride	1 U	1	Dibromochloromethane	3 U	3
Acetone	5 U	5	1,1,2-Trichloroethane	1 U	1
Carbon disulfide	1 U	1	Bromoform	1 U	1
1,1-Dichloroethene	1 U	1	4-Methyl-2-pentanone	3 U	3
1,1-Dichloroethane	1 U	1	2-Hexanone	3 U	3
trans-1,2-Dichloroethene	1 U	1	1,1,2,2-Tetrachloroethane	3 U	3
cis-1,2-Dichloroethene	1 U	1	Tetrachloroethene	1 U	1
Total 1,2-Dichloroethene	1 U	1	Toluene	1 U	1
Chloroform	1 U	1	Chlorobenzene	3 U	3
2-Butanone	3 U	3	trans-1,3-Dichloropropene	3 U	3
1,2-Dichloroethane	1 U	1	Ethylbenzene	1 U	1
1,1,1-Trichloroethane	1 U	1	cis-1,3-Dichloropropene	3 U	3
Carbon tetrachloride	1 U	1	Styrene	1 U	1
Vinyl acetate	1 U	1	Total Xylene	1 U	1

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	98	78	118
Toluene d8	107	83	117
p-Bromofluorobenzene	105	81	115

* Surrogate recovery is outside of control limits. See comments.

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Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9005133-02A
Client Sample ID: Method Blank

Date Received : 05/07/90
Date Extracted : 05/09/90
Test Code : LXTCSW

Collection Date : N/A
Date Analyzed : 05/16/90
Test Method : SW8270
Extraction Method : SW3510

Compound	Result (ug/L)		SDL (ug/L)
Phenol	8		2
Aniline	10	U	10
Bis(2-chloroethyl)ether	2	U	2
2-Chlorophenol	2	U	2
1,3-Dichlorobenzene	2	U	2
1,4-Dichlorobenzene	2	U	2
Benzyl alcohol	2	U	2
1,2-Dichlorobenzene	2	U	2
2-Methylphenol	2	U	2
Bis(2-chloroisopropyl)ether	2	U	2
4-Methylphenol	2	U	2
N-Nitroso-di-n-propylamine	2	U	2
Hexachloroethane	4	U	4
Nitrobenzene	2	U	2
Isophorone	2	U	2
2-Nitrophenol	4	U	4
2,4-Dimethylphenol	2	U	2
Benzoic acid	50	U	50
Bis(2-chloroethoxy)methane	2	U	2
2,4-Dichlorophenol	4	U	4
1,2,4-Trichlorobenzene	2	U	2
Naphthalene	4	U	4
4-Chloroaniline	2	U	2
Hexachlorobutadiene	2	U	2
4-Chloro-3-methylphenol	4	U	4
2-Methylnaphthalene	2	U	2
Hexachlorocyclopentadiene	4	U	4
2,4,6-Trichlorophenol	4	U	4
2,4,5-Trichlorophenol	4	U	4
2-Chloronaphthalene	2	U	2
2-Nitroaniline	4	U	4
Dimethyl phthalate	2	U	2
Acenaphthylene	2	U	2
2,6-Dinitrotoluene	4	U	4

Compound	Result (ug\L)		SDL (ug/L)
3-Nitroaniline	10	U	10
Acenaphthene	2	U	2
2,4-Dinitrophenol	20	U	20
4-Nitrophenol	20	U	20
Dibenzofuran	2	U	2
2,4-Dinitrotoluene	4	U	4
Diethyl phthalate	2	U	2
4-Chlorophenyl phenylether	2	U	2
Fluorene	2	U	2
4-Nitroaniline	4	U	4
4,6-Dinitro-2-methylphenol	20	U	20
N-Nitrosodiphenylamine	2	U	2
1,2-Diphenylhydrazine	4	U	4
4-Bromophenyl phenylether	4	U	4
Hexachlorobenzene	4	U	4
Pentachlorophenol	20	U	20
Phenanthrene	2	U	2
Anthracene	2	U	2
Di-n-butyl phthalate	2	U	2
Fluoranthene	2	U	2
Pyrene	2	U	2
Benzidine	50	U	50
Butylbenzylphthalate	2	U	2
3,3'-Dichlorobenzidine	20	U	20
Benzo(a)anthracene	2	U	2
Chrysene	2	U	2
Bis(2-ethylhexyl)phthalate	2	U	2
Di-n-octyl phthalate	2	U	2
Benzo(b)fluoranthene	4	U	4
Benzo(k)fluoranthene	4	U	4
Benzo(a)pyrene	4	U	4
Indeno(1,2,3-cd)pyrene	4	U	4
Dibenzo(a,h)anthracene	4	U	4
Benzo(g,h,i)perylene	4	U	4

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Chemistry, Microbiology, and Technical Services

GC/MS ABN surrogate recovery report for sample 9005133-02A

Surrogate	Percent Recovery	Limits: Min.	Max.
Nitrobenzene d5.....	76	45	105
2-Fluorobiphenyl.....	82	44	100
Terphenyl d14.....	89	20	140
Phenol d6.....	35	15	49
2-Fluorophenol.....	57	18	75
2,4,6-Tribromophenol.	89	26	122

* = Surrogate recovery outside control limits

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Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9005133-02A
Client Sample ID: Method Blank

Date Received : 05/07/90
Date Extracted : 05/09/90
Test Code : 8080

Collection Date : N/A
Date Analyzed : N/A
Test Method : SW 8080
Extraction Method : 3510PX

Report Units : ug/L

Compound	Result	SDL	Analysis Date	Confirmation Date
Alpha-BHC.....	0.1 U	0.1	05/16/90	05/16/90
Beta-BHC.....	0.1 U	0.1	05/16/90	05/16/90
Delta-BHC.....	0.1 U	0.1	05/16/90	05/16/90
Gamma-BHC.....	0.1 U	0.1	05/16/90	05/16/90
Heptachlor.....	0.1 U	0.1	05/16/90	05/16/90
Aldrin.....	0.1 U	0.1	05/16/90	05/16/90
Heptachlor Epoxide..	0.1 U	0.1	05/16/90	05/16/90
Endosulfan I.....	0.1 U	0.1	05/16/90	05/16/90
Dieldrin.....	0.1 U	0.1	05/16/90	05/16/90
4,4'-DDE.....	0.1 U	0.1	05/16/90	05/16/90
Endrin.....	0.1 U	0.1	05/16/90	05/16/90
Endosulfan II.....	0.1 U	0.1	05/16/90	05/16/90
4,4'-DDD.....	0.1 U	0.1	05/16/90	05/16/90
Endosulfan Sulfate..	0.1 U	0.1	05/16/90	05/16/90
4,4'-DDT.....	0.1 U	0.1	05/16/90	05/16/90
Methoxychlor.....	0.5 U	0.5	05/16/90	05/16/90
Endrin Ketone.....	0.1 U	0.1	05/16/90	05/16/90
Alpha Chlordane.....	0.5 U	0.5	05/16/90	05/16/90
Gamma Chlordane.....	0.5 U	0.5	05/16/90	05/16/90
Toxaphene.....	1.0 U	1.0	05/16/90	05/16/90
Aroclor-1016.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1221.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1232.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1242.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1248.....	0.5 U	0.5	05/16/90	05/16/90
Aroclor-1254.....	1.0 U	1.0	05/16/90	05/16/90
Aroclor-1260.....	1.0 U	1.0	05/16/90	05/16/90

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Chemistry, Microbiology, and Technical Services

Surrogate recovery report for sample 9005133-02A

Surrogate	Percent Recovery	Limits: Min.	Max.
Dibutylchlorendate.....	85	43	152
Isodrin.....	67	- 32	96

Converse GES Geoenvironmental Services

CHAIN OF CUSTODY RECORD

ect No.	Project Name
15527-03	Pacific Northern Oil

plers: (signature)

on	Date	Time	Comp.	Grab	Station Location	Number of Containers	Acid-Base Neutrals	Volatile organics EPA 624	Metals, Priority Pollutant by ICP (Be, Cd, Cr, Cu)	Metals by AA Sb, As, Pb, Ag, Tl	Hg by Cold Vapor (EPA 245.1)	Selenium by Gaseous Hydride	Pesticides/PCB's EPA 625	Phenols	Cyanide	Remarks
3	5-7-90	2:30		X	Well MW-3	2	X									2 - 1l amber
				X		2		X								2 - 40ml VOA vials
				X		1			X	X	X	X				1 - 1l plastic HNO_3 preserved
				X		1							X			1 - 500ml amber
				X		1								X		1 - 250ml amber $CuSO_4$-H_2PO_4 pres
				X		1									X	1 - 250ml NaOH preserve

inquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
R W. Mullen	5/7/90 4:45	Stuart Bronson			
inquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
inquished by Courier: gnature)	Date/Time	Received by Mobile Lab: (signature)	Relinquished by Mobile Lab: (signature)	Date/Time	Received by Courier: (signature)
thod of Shipment		Shipped by: (signature)	Courier from Airport: (signature)	Received for Laboratory: (signature)	Date/Time

Laucks 82 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063

Chemistry, Microbiology, and Technical Services

CLIENT: Converse Consultants NW
3131 Elliott Ave West, #550
Seattle, WA 98121

ATTN : John Strunk

Work ID : Pacific Northern Oil
Taken By : Client
Transported by: Hand Delivered
Type : Water

Certificate of Analysis
Work Order# : 90-06-220
DATE RECEIVED : 06/13/90
DATE OF REPORT: 06/28/90

SAMPLE IDENTIFICATION:

	Sample Description	Collection Date
01	MW-3 PNO Pier 91	06/13/90 10:55

The flag "U" indicates the analyte of interest was not detected, to the limit of detection shown.

Unless otherwise instructed all samples will be discarded on 08/07/90

Respectfully submitted,
Laucks Testing Laboratories, Inc.

J. M. Owens

Laucks 82 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
Chemistry, Microbiology, and Technical Services

CLIENT : Converse Consultants NW

Certificate of Analysis

Work Order # 90-06-220

TESTS PERFORMED AND RESULTS:

Analyte	Units	01
Soluble Sulfide	mg/L	0.1 U

9006220

Laucks
Testing Laboratories, Inc.
940 South Harney St. Seattle Washington 98108 (206)767-5060

HAIN OF CUSTODY RECORD

DATE 6·13·90 PAGE ____ OF ____

NE CONVERSE CONSULTANTS NW
DRESS 3131 ELLIOTT AVE
SEATTLE, WA
ENTION JOHN STRUNK
JECT NAME PACIFIC NORTHERN OIL
/PO NO.
MPLER (SIGNATURE) John Strunk (PRINTED NAME) JOHN STRUNK

B NO.	LAB SA #	SAMPLE NO.	DATE	TIME	LOCATION	SOLUBLE SULFIDE	NO. OF CONTAINERS	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
		MW-3	6·13·90	10:55	PNO PIER 91	✓	2	

TESTING PARAMETERS

INQUISHED BY	DATE	RECEIVED BY	DATE
John Strunk	6·13·90		
SIGNATURE		SIGNATURE	
JOHN STRUNK	TIME 11:45	PRINTED NAME	TIME
PRINTED NAME		COMPANY	
CONVERSE			
COMPANY			
INQUISHED BY	DATE	RECEIVED BY	DATE
		B. Uralles	6/13/90
SIGNATURE		SIGNATURE B. Uralles	
PRINTED NAME	TIME	PRINTED NAME	TIME
		LAUCKS TESTING LABS	1145

TOTAL NUMBER OF CONTAINERS:

SHIPMENT METHOD:

SPECIAL SHIPMENT, HANDLING OR STORAGE REQUIREMENTS

INSTRUCTIONS:

1. Shaded areas for lab use only.
2. Complete in ballpoint pen. Draw one line through errors and initial.
3. Be specific in test requests.
4. Check off tests to be performed for each sample.
5. Retain final copy after signing.
6. Provide name and telephone of your contact person.

NAME ERICK MILLER

TELEPHONE 285-5200

APPENDIX B

DRAFT INDUSTRIAL WASTE DISCHARGE PERMIT

issued by the Municipality of Metropolitan Seattle

METRO
Municipality of Metropolitan Seattle

Exchange Building • 821 Second Ave. • Seattle, WA 98104-1598

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

July 20, 1990

George Markwood
Pacific Northern Oil Company
100 West Harrison Plaza North Tower
Suite 200
Seattle, WA 98119

Draft of Permit No. 7597

Dear George:

Enclosed is a draft of the proposed Industrial Waste Discharge Permit No. 7597 for the Pacific Northern Oil Company's groundwater remediation project located on Pier 91 in Seattle.

This draft permit is for your review. Please notify this office of any comments about the draft permit within fourteen (14) days of the above date. If no comment is received and the permit fee has been paid, a signed permit will be issued thirty (30) days following the final date of public notice publication.

If you have any questions contact me at 684-2378.

Very truly yours,

Jacqueline Eden

Jacqueline A. Eden
Industrial Waste Investigator
Comprehensive Planning Division

:mwr
Enclosure

cc: Doug Knutson, Dept. of Ecology
Kris Effertz, City of Seattle
Doug Hotchkiss, Port of Seattle
Sylvia Burges, Environmental Protection Agency
Doug Hilderbrand, Metro

Permit No: 7597
Issuance Date: DRAFT
Expiration Date: DRAFT

WASTE DISCHARGE PERMIT

Municipality of Metropolitan Seattle METRO
Seattle, Washington 98104

In Accordance with the Provisions
of Chapter 90.48 RCW as Amended,
Public Law 92-500 and Metro
Resolution 3374, a Waste
Discharge Permit is
Issued to:

PACIFIC NORTHERN OIL COMPANY

Operation Location: Pier 91, Seattle, Washington

Mailing Address: 100 West Harrison Plaza North Tower,
Suite 200,
Seattle, WA 98119

Permission is hereby granted to discharge industrial wastewater from the above identified operation into the Metro sewer system in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

This permit is based on information provided in the permit application which together with the following conditions and requirements is considered part of the permit. All discharges authorized herein shall be consistent with the terms and conditions of this permit. This permit is not transferable without authorization from Metro.

By_____
Elsie J. Hulsizer
Industrial Waste Supervisor
Comprehensive Planning Division

S1. EMERGENCY CONTACTS

West Point Emergency Phone No: 24 HOURS
684-1800

Metro Industrial Waste Section Phone No: 7:30am - 4:00pm

Jacqueline Eden, Industrial Waste Investigator:
684-2378

Elsie Hulsizer, Industrial Waste Supervisor:
684-2364

Washington State Department of Ecology
Emergency Spill Phone No: 24 HOURS
867-7000

S2. COMPANY IDENTIFICATION

Discharge to: West Point Treatment Plant

Industry Type: Groundwater Reclamation Project

Limit Type: Metro Local Limits

SIC Code No.: 4953

Noncategorical

Metro Sample Site Station No. A4344

Description of Metro Sample Site:

Sample tap on the oil/water separator outlet.

Discharge from site No. A4344 is not categorical.

Hazardous Waste Generator No.: WAD981760762

S3. SAMPLE SITE ACCESS AND IDENTIFICATION

A. Unobstructed access to sample sites shall be available to authorized Metro personnel during normal operating hours. The permittee shall be responsible for providing alternate sample sites in the event of access obstruction or upon evidence of monitoring equipment molestation.

B. The permittee shall allow Metro to permanently label

the sample sites used to collect wastewater samples.

S4. NOTIFICATION REQUIREMENTS

A. Spills

The permittee shall notify Metro immediately in the event of a spill to the sanitary sewer.

B. Changes In Discharge Characteristics

The permittee shall inform Metro prior to :

1. A significant alteration (> 20% increase from permit application) in the volume or nature of their industrial discharge.

2. Discharge of waste streams not listed in the permit application.

Following the notification discharge may commence upon receipt of written permission from Metro.

C. Continuing Discharge After Permit Expiration Date

This permit does not authorize discharge after its expiration date. If the permittee wishes to continue discharge after the expiration date an application must be filed for reissuance of this permit at least 180 days prior to the expiration date.

S5. EFFLUENT LIMITATIONS

A. General Requirements

1. The permittee's discharge shall not interfere with the operation of the municipal sewer system, cause Metro to exceed its NPDES permit limits, or endanger local utility or Metro sewer workers.

2. Wastewater from regulated processes shall comply with the effluent limitations prior to dilution with other wastewaters unless a fixed alternative discharge limit is approved by Metro.

B. Violation Criteria

Criteria for determining violations are explained in Section S10. Resolution 3374 also lists criteria for mass violations and reporting violations. Exceeding

S7. SPECIAL CONDITIONS

A. Monitoring Requirements

In addition to self-monitoring requirements identified in S6, once every month for the first three months of operation and once every six months thereafter, the permittee shall collect and analyze samples for parameters listed in S5, item C. TTOs shall be analyzed in accordance with EPA Method 624. In addition, the samples shall be analyzed for total xylenes. Data shall be submitted by the 15th of the month following data collection, on a self-monitoring report form. The permittee shall not be required to submit data to satisfy the conditions of S6, item D1 during months when data is being submitted to meet the requirements of S7, item A.

B. Operating Procedures

The permittee is expected to pay close attention to the following common sense criteria whenever discharge to the sanitary sewer is occurring:

1. There shall be no pronounced odor of solvent or gasoline.
2. There shall be no pronounced oil sheen or unusual color.
3. There shall be no pronounced hydrogen sulfide (rotten egg) odor.
4. There shall be no visibly pronounced turbidity, the discharge must remain translucent.

If any of the common sense criteria are exceeded, the permittee must stop discharging and notify the emergency contacts listed in S1.

S8. SUMMARY OF REQUIRED REPORTS

The permittee shall submit reports to Metro according to the schedule listed below.

Report Name:	SELF MONITORING REPORT
Frequency:	As specified in Sections S6 and S7.
Due Date:	Report to be filed no later than the 15th day of the time period following the sample collection. (i.e., the 15th of each month for monthly sampling).

Content/Comments:	The monthly self-monitoring reports shall contain the data specified in S6 and S7 or, if appropriate, a notification that no discharge has occurred.
Report Name:	SPILL OR UPSET CONDITIONS REPORT
Frequency:	As needed.
Due Date:	Within fourteen (14) days after the spill notification.
Content/Comments:	Reason, characteristics of spill and corrective action taken.
Report Name:	REPORTS OF DISCHARGE VIOLATIONS
Frequency:	As needed.
Due Date:	Fourteen (14) days after violation known to permittee.
Content/Comments:	Reason for violation and corrective actions taken.
Report Name:	REPORT FOR INSTALLATION UPGRADE OF PRETREATMENT SYSTEM - per WAC 173-240
Frequency:	As needed prior to installation or upgrade.
Due Date:	N/A
Content/Comments:	Approval required before installation/upgrade occurs.
Report Name:	COPIES OF DANGEROUS WASTE REPORTS FILED WITH DEPARTMENT OF ECOLOGY
Frequency:	As requested by Metro.
Due Date:	N/A
Content/Comments:	As required by the Washington Department of Ecology.
Report Name:	REPORT ON NONREQUIRED SELF MONITORING
Frequcy:	As nonrequired samples are collected.
Due Date:	Same as self monitoring report for dates of sample collection, i.e. the 15th day of the month following the sample collection.
Content/Comments:	See S6, item C

S.9 MONITORING AND RECORD KEEPING

The permittee shall monitor their discharge to the municipal sewer. It shall be the responsibility of the permittee to take whatever steps are necessary to insure discharge requirements are met. All records required by the permit shall be available for review at reasonable times by authorized representatives of the Municipality of Metropolitan Seattle.

A. Recording of Results

For each measurement or sample taken to comply with this permit, the permittee shall record the following information:

1. the date, exact place and time of sampling;
2. the dates the analyses were performed;
3. the person who performed the analyses;
4. the analytical techniques or methods used;
5. the results of all analyses.

B. Record Retention

Records of all such testing shall be retained for a period of three (3) years unless litigation or the direction of the Executive Director requires an extension of that time.

C. Representative Sampling

Samples and measurements taken to meet the requirements of this condition shall be representative of the volume and nature of the monitored discharge.

D. Test Procedures

All analyses shall be performed in accordance with procedures established by the Administrator of EPA pursuant to Section 304(g) of the Clean Water Act and contained in 40 CFR Part 136 and amendments thereto or with any other test procedures approved by the Administrator, and/or Metro. In all cases the detection limit shall be well below the discharge limit. Where 40 CFR Part 136 does not include a sampling or analytical technique for the pollutant in question, sampling and analysis shall be performed in accordance with the procedures set forth in the EPA publication entitled "Sampling and Analysis Procedures for Screening of Industrial

Effluents or Priority Pollutants, April, 1977" or "Standard Methods", 1985 Edition and amendments thereto, or with any other sampling and analytical procedures approved by the Administrator. Analysis of FOG shall be in accordance with method numbers 503A and 503F in "Standard Methods", 1985 Edition.

E. Falsifying Information

The act of knowingly falsifying, tampering with, or knowingly rendering inaccurate any monitoring device, report or method required pursuant to the federal pretreatment standards, Metro Resolution 3374, or special condition of this permit shall constitute a violation of this permit, and shall be subject to the legal remedies available under Section 6-06 and Section 13 of Metro Resolution 3374.

F. Toxicity Testing

In the event Metro is required by the Department of Ecology to determine the source of a pattern of acute toxicity pursuant to its Treatment Plant NPDES permit, the permittee may be required to test its effluent for toxicity according to procedures to be determined by Metro.

S10. Criteria Constituting a Violation

A. A violation of those limits established under Section 4 of Metro Resolution 3374, federal, state or Metro pretreatment standards, or specific requirements of an industrial waste discharge permit shall occur, regardless of intent or accident, when:

1. The criteria listed in Section 10 of Metro Resolution 3374 are exceeded.

2. The numerical or qualitative value of any federal pretreatment standard is exceeded. Those parameters designed by (*) in S5 of this permit are federal pretreatment standards.

3. The temperature limitation of 150 degrees Fahrenheit is exceeded for any single sample or the discharge causes the temperature at the treatment works to exceed 104 degrees Fahrenheit.

B. A review of any violation will include consideration of testing accuracy prior to enforcement action.

C. The more restrictive limitation (concentration or mass)

shall prevail for determining violations.

S11. OPERATIONS AND MAINTENANCE

The permittee shall use waste preventative practices to reduce or eliminate contaminant loading to the Municipal Sewer System. These practices shall include proper chemical storage, spill prevention and notification, and maintenance and operation of any required pretreatment equipment.

A. Chemical Storage

Chemical solutions, solid chemicals, waste materials, oils and solvents shall be stored in a manner that will prevent the entry of these materials into the municipal sewer system.

1. Noncompatible chemicals shall be segregated and securely stored in separate containment areas that prevent mixing of incompatible or reactive materials.
2. The permittee shall install shut-off devices to all drains in any hazardous waste storage areas.
3. Chemicals shall be dispensed only in roofed and bermed areas that eliminate potential spills to the municipal sewer system.
4. All empty barrels which have not been steam-cleaned shall be adequately stoppered and stored in an upright position.
5. Process tanks shall be located in a bermed, roofed, secured area capable of containing 105 percent of the volume of the largest tank. The permittee shall insure that process solutions are used and stored in such a manner as to minimize spills of concentrated solutions to the sanitary sewer.

B. Spill Prevention/Notification

The permittee shall notify Metro immediately in the event of a spill to the sanitary sewer.

1. In the event of a concentrated solution spill such as a tank failure, the permittee shall not discharge any spilled solution to the municipal sewer system unless laboratory test results indicate that the substance meets the conditions of this permit. The permittee shall receive approval from the Metro Industrial Waste Section prior to any discharge of spilled solutions.

2. Concentrated waste or spilled chemicals which do not meet, or are not treated to meet, the discharge conditions of this permit shall be transported offsite for disposal at a facility approved by the Department of Ecology or appropriate County Health Department.

3. The permittee shall maintain and inspect all process solution tanks on a regular basis. Any leaks shall be repaired promptly.

4. The permittee shall use spill prevention practices to preclude the discharge of liquids, solids, or gases, which by reason of their nature or quantity are, or may be, sufficient either alone or by interaction with other substances to cause fire or explosions.

5. All process tanks and chemical storage containers shall be accurately labeled. Emergency phone numbers of Metro, Fire Departments, your company's 24-hour corporate contact and WDOE shall be posted at all sites that Metro requires.

7. The permittee shall insure that concentrated wastes from process tank filters and other equipment is prevented from entering the sanitary sewer unless it is treated to meet the discharge conditions of this permit.

C. Pretreatment Equipment Maintenance and Operations

All pretreatment systems used to bring the permittee's discharge into compliance with Metro's discharge limitations shall be maintained continuously in satisfactory and effective operations by the permittee at his expense, and shall be subject to periodic inspections by authorized Metro Personnel. These systems shall be attended at all times during discharge to the municipal sewer system. In the event that such equipment fails, the permittee must notify Metro immediately and take spill prevention precautions.

1. Plans for all pretreatment facilities or equipment, whether initial installation or modification of existing equipment, shall be reviewed and approved by Metro and the Washington Department of Ecology prior to construction or initiation.

2. Metro shall be contacted before the beginning of any limited experimental modifications or new equipment testing that could reasonably be expected to affect effluent quality or quantity. This experimental work shall proceed only after securing written approval from Metro and following the permittee's adherence to any applicable special conditions.

3. The effluent limitations specified in this permit are to be met by treatment of the wastes for pollutant removal. The use of municipal water, groundwater, seawater, storm water or other materials, including waste products, for the purpose of diluting a waste to achieve those limitations is prohibited.

D. Sewer Meter Requirements

1. The permittee shall obtain or maintain access to a sewer meter which can provide accurate information regarding groundwater discharge to the sewer, or use other methods approved by Metro for calculating volume of discharge to the sewer.

E. pH

1. The permittee shall cease discharge whenever a Metro representative requires, or an effluent check shows a pH violation (as defined in Metro Resolution 3374, Section 10 - Violations). No discharge shall be resumed until the effluent is neutralized to an acceptable level.

2. The permittee shall maintain a log of all pH checks or a continuous record of effluent pH's as required in S6 - Monitoring Responsibilities.

F. Solid Waste

1. The permittee shall handle and dispose of all solid waste material (as defined in WAC 173-304-100) in such a manner as to prevent their entry into the municipal sewer system.

2. All covers, screening devices, sumps, hoppers, conveyors and other facilities provided for the recovery and handling of waste solids are to be maintained in an efficient operating condition.

G. Stormwater/Cooling Water

1. Storm water and cooling water shall be excluded, except where specifically authorized by this permit, from the municipal sewer system.

S12. GENERAL CONDITIONS

A. All discharges and activities authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant more frequently than, or at a level in excess of, that identified and authorized by this permit shall constitute violation of the terms and conditions of this permit. Whenever the permittee refuses to take corrective action or continues the violating condition, the imposition of civil penalties and/or termination of this permit may result. Termination of this permit may require disposal of the industrial waste in some manner other than into the public sewer, private sewer, or side sewer tributary to the municipal sewer system at the expense of the person holding the permit.

B. Any facility changes which will result in a significant change in character or volume of pollutants discharged to the municipal sewer system must be reported to the permit authority. No change shall be made until plans have been approved and a new or modified permit has been issued. In no case are any new connections, increased flows, or significant changes in influent quality permitted that will cause violation of the effluent limitations specified herein.

C. The diversion or bypass of any discharge from any pretreatment facility utilized by the permittee to maintain compliance with the terms of this permit is prohibited except where unavoidable to prevent loss of life or severe property damage. The procedure outlined in paragraph D shall be followed in case of such a diversion or bypass.

D. In the event the permittee is unable to comply with any of the conditions of this permit because of a breakdown of equipment or facilities, an accident caused by human error, negligence, or any other cause, such as an act of nature, the permittee shall:

1. take immediate action to stop, contain and clean up the unauthorized discharges and correct the problem.
2. immediately notify the Municipality of Metropolitan Seattle so steps can be taken to prevent damage to the sewerage system.

3. submit a written report describing the breakdown, the actual quantity and quality of resulting waste discharged, corrective action taken, and the steps taken to prevent a recurrence.

Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

E. The permittee shall adequately maintain and efficiently operate all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

F. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

1. A violation by the permittee of any terms or conditions of this permit;
2. Securing of the permit by the permittee through misrepresentation or failure to fully disclose all relevant facts; or
3. A change in any condition that requires a temporary or permanent reduction or elimination of permanent discharge. The purpose of such reduction or elimination shall be to allow Metro to: a) insure compliance with the requirements of any Federal or State law or administrative regulation relating to water pollution; b) ensure Metro performs its statutory function under RCW 35.58.200; and c) meet any emergency.

G. The permittee shall, at all reasonable times, allow authorized representatives of the Municipality of Metropolitan Seattle:

1. to enter that portion of the premises where an effluent source or disposal system is located or in which any records are required to be kept under the terms and conditions of this permit;

2. to inspect any monitoring equipment or monitoring methods required by this permit; or

3. to sample any discharge of pollutants.

H. If a toxic standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Federal Clean Water Act for a toxic

pollutant which is present in the discharge authorized herein, and such standard or prohibition is more stringent than any limitation upon such pollutant in the permit, the permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee shall be so notified. Section 307(a) requires that the Administrator of the Environmental Protection Agency shall promulgate effluent standards (or prohibition) for toxic pollutants which he has listed as such.

I. Nothing in this permit shall be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

J. This permit does not constitute authority for discharge into waters of the state. Any such discharge is subject to enforcement action by the Department of Ecology.

K. All requirements and ordinances of Metro pertaining to the discharge of wastes into the municipal sewer system are hereby made a condition of this permit.

L. All requirements and ordinances of the Environmental Protection Agency and the Department of Ecology pertaining to hazardous and toxic wastes, disposal facilities, and discharge of wastes into the municipal sewer system, are hereby made a condition of this permit.

M. Should the permittee intend to initiate any additional chemical or waste processing activity not listed in their permit application, to include other unspecified activities, or implement any change in processing or general operations that would alter the characteristics of facility effluent, it will be necessary for the permittee to submit plans describing these additions or changes for review and approval prior to any such initiation, implementation or change.

S13. WASHINGTON DEPARTMENT OF ECOLOGY (ECOLOGY) CONDITIONS

Upon issuance of this permit, the permittee assumes the responsibility to abide by the following environmental requirements, and any other appropriate regulations stipulated by the Department of Ecology. **The Department of Ecology retains authority to enforce these permit conditions (RCW 70.105 and RCW 90.48).**

A. Conditions To Protect Ground and Surface Waters

1. Contaminated waters or wastes shall not be discharged to state waters.
2. Boiler blow down and water shall not be discharged to state waters.
3. Solid chemicals, chemical solutions, waste materials, oils and solvents shall be stored in a manner which will prevent the entry of these materials into State ground or surface waters, and in a manner that will prevent spillage by overfilling, tipping or rupture.
4. The permittee shall handle and dispose of all solid waste material in such a manner as to not cause any adverse effect on ground or surface water quality.
5. Filtered solids or sludge shall be stored in such a manner that drainage from this material is prevented from either draining across public rights-of-way or entering the local storm drain system or the ground water.
6. No emulsifiers or dispersants are to be used on waters of the state without approval from the Department of Ecology.

Questions regarding the implementation of conditions outlined in Section S13 should be directed to the regulatory authority, the Washington State Department of Ecology, at 867-7000 (Northwest Regional Office, Redmond, Washington).

S15. <u>TTO Definition/Reporting Requirements (413/433)</u>

A. TTO Definition (From 40 CFR, 433.11 and 413.02)

The term "TTO" shall mean total toxic organics, which is the summation of all quantifiable values greater than the Practical Quantitation Limits (PQL) listed in EPA SW-846 Methods 8270 and 8240 or 0.01 milligrams per liter, which ever is greater, for the following toxic organics:

Acenaphthene
Acrolein
Acrylonitrile
Benzene
Benzidine
Carbon tetrachloride (tetrachloromethane)
Chlorobenzene
1,2,4-trichlorobenzene
Hexachlorobenzene
1,2-dichloroethane
1,1,1-trichloroethane
Hexachloroethane
1,1-dichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
Chloroethane
Bis(2-chloroethyl) ether
2-chloroethyl vinyl ether(mixed)
2-chloronaphthalene
2,4,6-trichlorophenol
Parachlorometa cresol
Chloroform (trichloromethane)
2-chlorophenol
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3-dichlorobenzidine
1,1-dichloroethylene
1,2-trans-dichloroethylene
2,4-dichlorophenol
1,2-dichloropropane
2,4-dimethylphenol
2,4-dinitrotoluene
2,6-dinitrotoluene
1,2-diphenylhydrazine
Ethylbenzene
Fluoranthene
4-chlorophenyl phenyl ether
4-bromophenyl phenyl ether
Bis (2-chloroisopropyl) ether
Bis (2-chloroethoxy) methane
Bromoform (tribromomethane)
Dichlorobromomethane
Chlorodibromomethane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
Naphthalene
Nitrobenzene
2-nitrophenol
4-nitrophenol
2,4-dinitrophenol
4,6-dinitro-o-cresol
N-nitrosodimethylamine

N-nitrosodiphenylamine
N-nitrosodi-n-propylamine
Pentachlorophenol
Phenol
Bis (2-ethylhexyl) phthalate
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
1,2-benzanthracene (benzo(a)anthracene)
Benzo(a)pyrene (3,4-benzopyrene)
3,4-Benzofluoranthene (benzo(b)fluoranthene)
11,12-benzofluoranthene (benzo(k)fluoranthene)
Chrysene
Acenaphthylene
Anthracene
1,12-benzoperylene (benzo(ghi)perylene)
Fluorene
Phenanthrene
1,2,5,6-dibenzanthracene (dibenzo(a,h)anthracene)
Indeno (1,2,3-cd) pyrene) (2,3-o-phenylene pyrene) Pyrene
Tetrachloroethylene
Toluene
Trichloroethylene
Vinyl Chloride (chloroethylene)
Aldrin
Dieldrin
Chlordane (technical mixture and metabolites)
4,4-DDT
4,4-DDE (p,p-DDX)
4,4-DDD (p,p-TDE)
Alpha-endosulfan
Beta-endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
(BHC-hexachlorocyclohexane)
- Alpha-BHC
- Beta-BHC
- Gamma-BHC
- Delta-BHC

(PCB-polychlorinated biphenyls)
- PCB-1242 (Arochlor 1242)
- PCB-1254 (Arochlor 1254)
- PCB-1221 (Arochlor 1221)
- PCB-1232 (Arochlor 1232)
- PCB-1248 (Arochlor 1248)
- PCB-1260 (Arochlor 1260)
- PCB-1016 (Arochlor 1016)

Toxaphene
2,3,7,8-Tetrachlorodibenzo-p-dioxin
(TCDD)